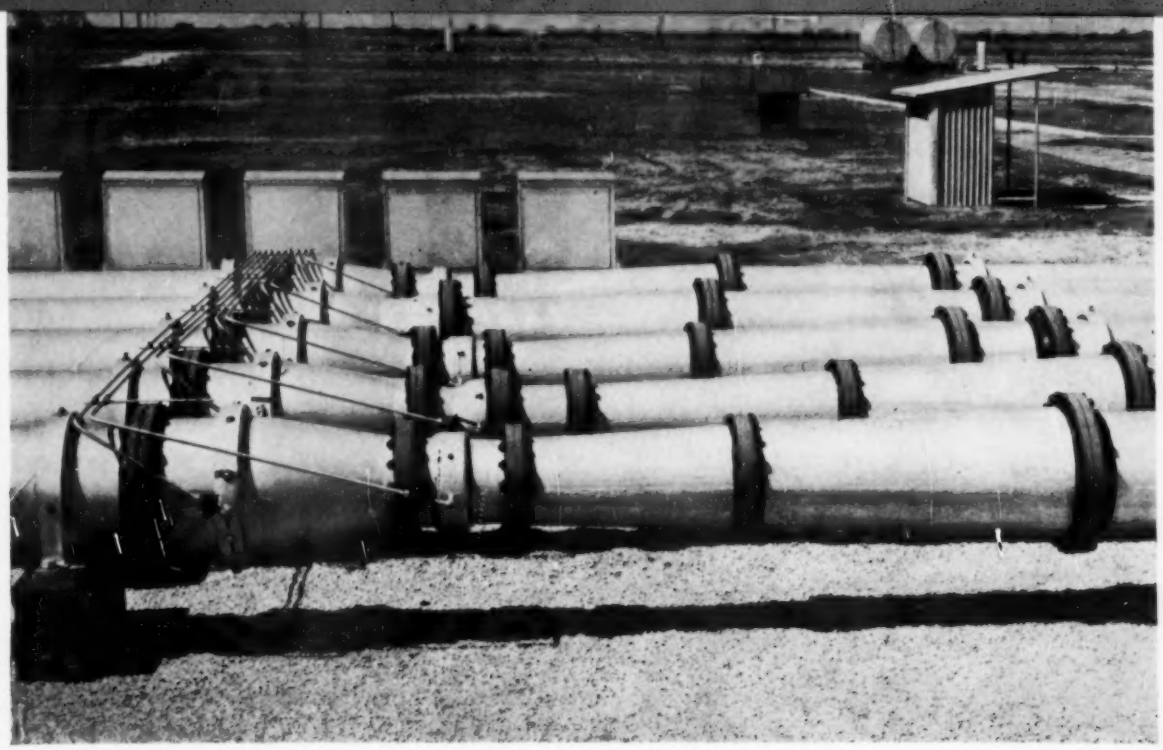
PETROLEUM PROCESSING

including Petrochemical Processing Section

JANUARY 1954



Use Venturi Tubes for metering big-volume, low-pressure gas flows—p. 66

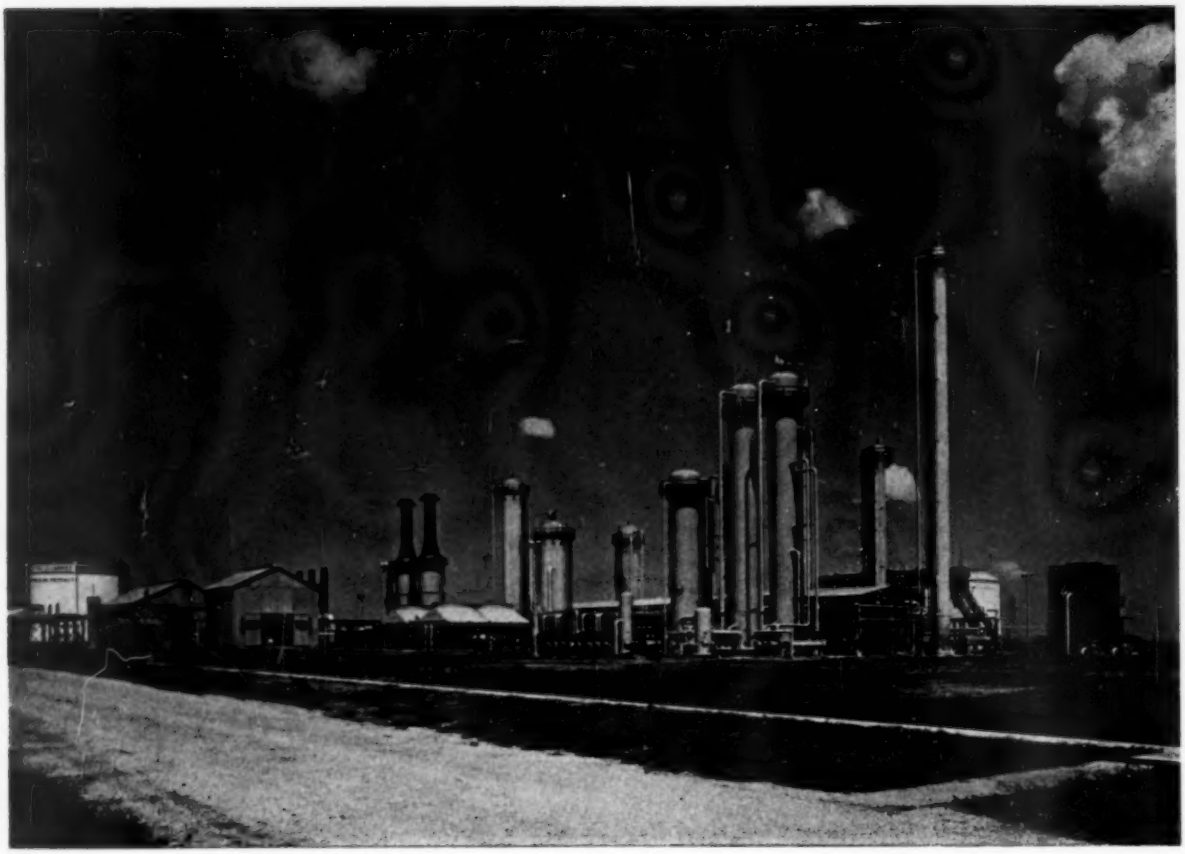
Tops in "What's New!"—1953

Here's the leading new equipment ideas developed during the past year—p. 60

Systematize Your Stores

How a big petrochemical plant reduced tied-up inventory by $500,000—p. 86

A McGRAW-HILL PUBLICATION



The NEW *Ambrose Gasoline Plant*

at Blackwell, Oklahoma Processes Gas From the Cross Country Pipe Line of Cities Service Gas Company

Through the operation of this plant, designed to produce daily over 4500 barrels of fractionated liquid products from pipe line gas, another completely satisfied plant owner, CITIES-BLACKWELL CORPORATION, is added to the long list of oil and gas companies entrusting such multi-million dollar projects to *HUDSON*, experienced in 20 years of designing and building gas processing plants.

The HUDSON organization, qualified by years of experience in the successful design, construction and operation of major oil and gas processing plants, offers its specialized services for projects in any part of the world.

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

We're mighty interested in the new baby

Each time a new model car is announced, the manufacturer who produced it is as proud as a new papa. And refiners, too, are interested, because they have vital interest in keeping these new babies running just as they left the showroom.

What will be the fuel or lubricant requirements of the new arrival? What are its octane requirements, and what will they be as it grows older?

To help answer these questions, whenever it appears that a new car will have a new or modified engine, the Ethyl Research Laboratories in Detroit obtain several of the early production models for test purposes.

They are carefully given a recommended break-in, then road-tested for octane requirement as clean engines. Additional mileage is then accumulated in order

(Continued on next page)

ETHYL
ANTIKNOCK COMPOUND
ETHYL CORPORATION

Printed in U.S.A.

We're mighty interested in the new baby

(*Continued from preceding page*)

to measure changes in this requirement as the car grows older.

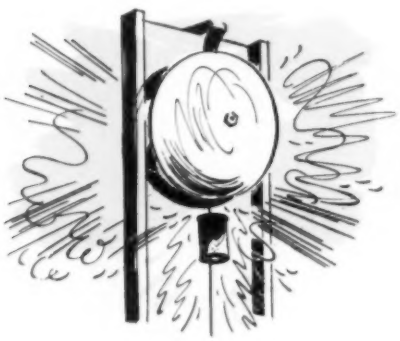
Not only do we test these new cars ourselves in cooperation with the manufacturers, but we make them available to refiners who want to test their own products in them.

This new-car-requirement program is only a small part of the research activity Ethyl carries on in serving the petroleum industry. But it is of such direct and understandable benefit that we like to point to it as an example of the many services you get when you buy "Ethyl" antiknock compound.

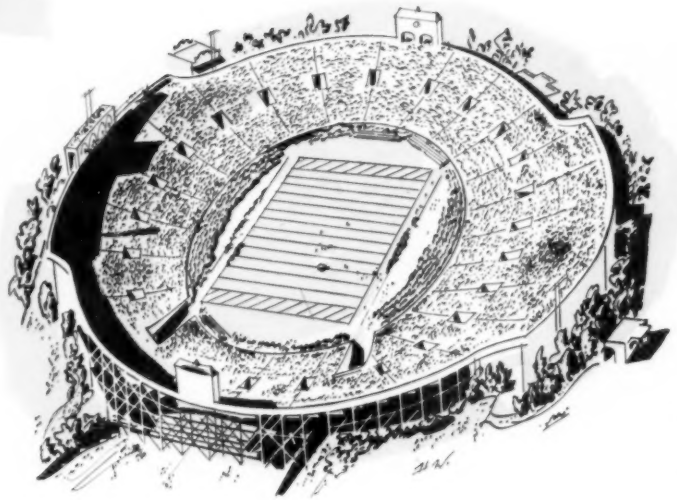
ETHYL CORPORATION

NEW YORK 17, NEW YORK

WORTH NOTING



Ethyl's national advertisements promoting your best gasoline are consistently among the best-read advertisements in the magazines in which they appear!



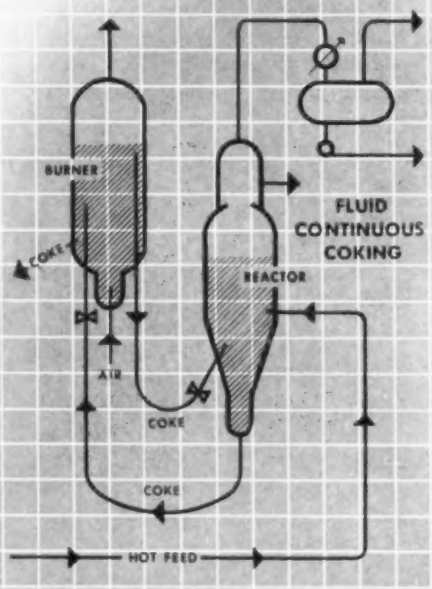
The Rose Bowl in Pasadena, California, will seat 89,090 spectators. Just *one* of the weekly audiences last year for Ethyl's TV commercials promoting your best gasoline would fill 47 Rose Bowls!

The gasoline used last year by Ethyl for test purposes alone would run a Greyhound bus 103 times around the world!

Ethyl Service is backed by 30 years of antiknock experience

Fluid Coking

THE ANSWER TO YOUR HEAVY FUEL PROBLEM



SUPPLIES ITS OWN HEAT
DRY, UNIFORM COKE
SIMPLE COKE HANDLING AND STORAGE
IMPROVED LIQUID YIELD

NO FURNACE
NO HYDRAULIC DECOKING
NO COKE DEWATERING
NO SLOPPY COKE PILE

Now available through FLUOR

The new Fluid Coking Process, perfected by Standard Oil Development Company, will render obsolete *all* delayed cokers. Fluid Coking does not require a furnace: a hot stream of finely-divided coke particles provides the heat and surface area required to crack heavy residual fractions. The process is truly continuous and coke is taken off in one steady stream, almost like a fluid. Decoking is no longer necessary.

Heavy feedstocks – atmospheric column residues, pitches from deep vacuum distillation, feeds with A.P.I. gravities as low as 0° or those with Conradson Carbons as high as 35% can be processed. Coke yields are lower than in the delayed process.

Fluid Coking is flexible. Changes in feed and temperature can easily be compensated for and long on-stream times may be expected. Fluid Coking is economically attractive. Costs are less than for the older process and the yield of light products is greatly increased.

For details on Fluid Coking, write or call your Fluor representative today.

BE SURE WITH

FLUOR

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA

FOREIGN: FACTS FLUOR - PARIS
FLUOR OF CANADA - TORONTO
FLUOR INTERNATIONAL - BEIRUT
FLUOR PERUANA, S.A. - LIMA
HEAD WRIGHTSON - LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA

The Petroleum Industry Insists On

HARTZELL Fans for Its

Cooling Towers and Heat Exchangers

Hartzite plastic for cooling tower and heat exchanger fan blades was developed especially to meet the rugged requirements of the petroleum industry. After more than ten years of service in the most punishing installations, Hartzite blades have proved themselves beyond all expectations.

What evidence is there of the superiority of Hartzell cooling tower and heat exchanger fans with Hartzite blades? Nearly every Hartzell fan installed since the introduction of the Hartzite blade in 1941 is still in service. And in nearly every case, where one Hartzell fan has been installed on a battery of cooling towers or heat exchangers, more Hartzells have followed as other blades needed replacement.

Fabric-base Hartzite absorbs vibration. Its strength is many times that necessary to withstand normal stresses. Its unusual resistance to corrosion and abrasion is constant throughout the blade. Hubs are of welded steel with an extremely high safety factor.

These are the reasons why Hartzell has become "the" cooling tower and heat exchanger fan in the petroleum industry.

For the complete story, send for Bulletin 1503.

HARTZELL

propeller fan co.

Div. of Castle Hills Corp.

Name _____

Company _____

Street & Number _____

City & State _____

If student, check here for special information ☐

Dept. K

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

(To obtain more data on advertised products see page 128)

PETROLEUM PROCESSING

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels lubricants and chemicals.

January, 1954
Vol. 9, No. 1

Contents

FEATURE ARTICLES

Refining Section

Spark Plug Fouling & Preignition 53
What researchers have found out about these consequences of fuel deposits

Outdoor Metal Clad Switchgear 55
Smaller space and cheaper installation are two of the advantages cited, by Earle R. Hoyle

Why Not Bend That Pipe? 58
In sizes up to 4 or 6 in., you can speed up installation and save money on fittings

Tops in "What's New!"—1953 60
Brief repeats of most interesting items reviewed in 1953 "What's New" section

New Vent Valve Cuts Vapor Losses 62
"All-weather" unit developed in Sun refinery is sealed in antifreeze

Venturi Tube vs. Orifice Plate 66
For metering high-volume gas flow, the experience of a Texas refinery, by Dan T. McDonald

Five Steps to Lower Corrosion Costs 72
How to make a concerted attack on this refiner's bugbear, by V. B. Guthrie

Controlled Volume Pumps 75
What they are, how they work, and how you can use them as "instruments," along with three typical jobs for them, by John Procopi

Petrochemical Section

Man-size Petrochemical Venture 83
First major step in Sun Oil's program is aromatics plant in center of marketing area, by V. B. Guthrie

Put System in Your Stores 86
Celanese's method of handling stores at its Bishop, Texas, plant, by James E. Mercer

Mesitylene from Acetone 92
A continuous catalytic process which gives excellent yields, by Kenneth A. Kobe and Leo J. Hirth

DEPARTMENTS

Publisher's Page	5	Plant Practices	99	Operating Trends	123
What's Happening	7	Lab Practices	103	Information Offered	126
Tomorrow	11	Patents	105	Advertisers' Index	128
Letters	15	Personals	109	What's New	129
News in Views	97	Suppliers	113	Editorials	144
New Words	97	Meetings	119		

A McGRAW-HILL PUBLICATION

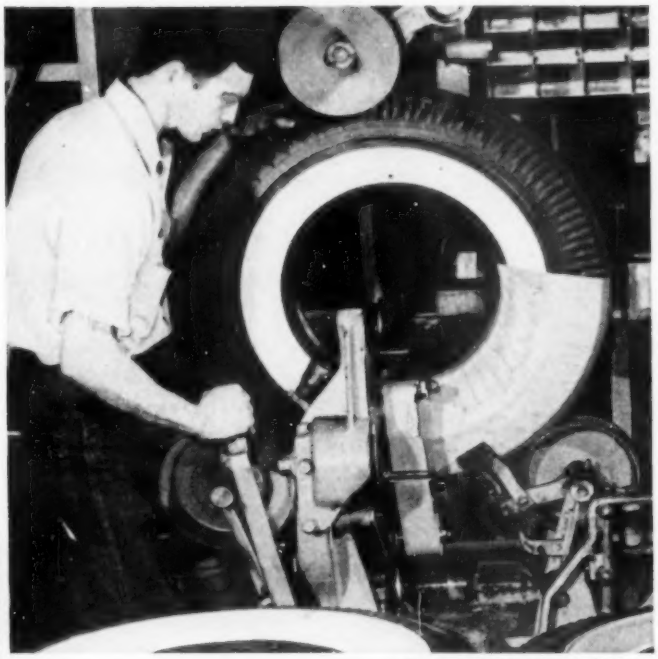
Editorial & Business Offices
330 West 42nd St., New York 36, N. Y.

Editorial Staff

William F. Bland, Editor
Virgil B. Guthrie, Associate Editor
William C. Uhl, Associate Editor—Equipment
William A. Caperell, Jr., Art Director
Stuart D. Boynton, Editorial Assistant
Jane L. Witzig, Editorial Assistant

D. P. Thornton, Jr., Southwestern Editor
810 First Nat'l. Bank Bldg., Houston 2
Frank Breese, West Coast Editor
1111 Wilshire Blvd., Los Angeles 17
Andrew R. Patla, Washington Editor
1188 Nat'l. Press Bldg., Washington 4
Peter J. Gaylor, Patent Reviewer

Motor Oil and Gasoline (Additives)



Synthetic Rubber, Synthetic Yarns

Paint, Varnish and Shellac

for a complete line of high quality chemical products

PETROLEUM

PARANOX
PARATONE
PARAFLOW
PARAPOID
PARADYNE
PARATAC
PETROHOL
Methyl Ethyl Ketone
Dewaxing Aid
Ethyl Ether
Isopropyl Ether
Reference Fuels

SURFACE COATING

PETROHOL 91
PETROHOL 95
PETROHOL 99
JAYSOL
Secondary Butyl Alcohol
Secondary Butyl Acetate
Isopropyl Acetate
Acetone
Methyl Ethyl Ketone
Ethyl Ether
Isopropyl Ether
Dicyclopentadiene
Naphthenic Acids
Iso-Octyl Alcohol
Decyl Alcohol
Denatured Ethyl Alcohol

CHEMICAL

PETROHOL 91
PETROHOL 95
PETROHOL 99
JAYSOL
Iso-Octyl Alcohol
Decyl Alcohol
Denatured Ethyl Alcohol
Tridecyl Alcohol
Dicyclopentadiene
Isoprene
Butadiene
Ethyl Ether
Isopropyl Ether
Tripropylene
Tetrapropylene
Aromatic Tars
Benzene
Acetone
Methyl Ethyl Ketone

To add the ingredients of success...specify

ENJAY

34 successful years of leadership in serving industry

Get assured success—back your product with the research, experience and proved results of a pioneer leader. The Enjay Company not only supplies many different industries with a complete line of petrochemicals—Enjay also is ready to assist in the application of its products and in developing new or improved products to meet industry requirements. You can count on high quality Enjay chemical products—be sure to call Enjay for your chemical needs.

ENJAY COMPANY, INC. • 15 West 51st Street, New York, 19 N. Y.

(To obtain more data on advertised products see page 128)

PETROLEUM PROCESSING

A McGRAW-HILL PUBLICATION

Editorial & Business Offices
330 West 42nd St., New York 36, N.Y.

Harry L. Waddell, *Publisher*
Warren C. Platt, *Consulting Editor*

Business Staff

William J. Parkin, Advertising Sales Mgr.
K. W. McKinley, Research & Promotion Mgr.
Fred R. Emerson, Business Mgr.
John E. Thompson, Production Mgr.

Regional Sales Representatives

NEW YORK 36, N. Y.
P. S. Carberry, 330 West 42nd St.

PHILADELPHIA 3, PA.
C. J. Jefferis, 17th and Sansom Sts.

ATLANTA 3, GA.
R. H. Sidur, 1321 Rhodes-Haverty Bldg.

CLEVELAND 15, OHIO
Richard N. Jorgenson, 1510 Hanna Bldg.

CHICAGO 11, ILL.
R. D. Henriquez, 520 North Michigan Ave.

HOUSTON 2, TEXAS
George Reid, 810 First Nat'l Bank Bldg.

SAN FRANCISCO 4, CALIF.
Ralph Dorland, 68 Post St.

LOS ANGELES 17, CALIF.
Joseph Allen, 1111 Wilshire Blvd.

Petroleum Processing is published the second Tuesday of each month by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948) founder.

Publication Office: 1309 Noble St., Philadelphia 23, Pa.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to **Petroleum Processing**, Subscription Service, 330 West 42nd St., New York 36, N. Y. Subscription rates: domestic single copies 25¢. United States and possessions, $2 per year, $3 for two years, $4 for three years; Canada, $3 per year, $4 per two years, $5 for three years; Latin America, $8 per year, $12 for two years, $16 for three years; all other countries $10 per year, $16 for two years, $20 for three years.

Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology. Acceptance under section 34.64 P.L.&R. authorized.
Printed in U.S.A. Copyright 1954 by McGraw-Hill Publishing Co., Inc. All rights reserved.

Publisher's Page

More Changes You Should Know About

LAST month I told you about our move to new editorial offices in New York City. This month I'd like to talk about a few more moves—among our staff.

Warren C. Platt, who has been publisher of PETROLEUM PROCESSING since it was founded in 1946 and editor-publisher of *National Petroleum News* since he started that magazine in 1909, left those positions the first of the year. He has bought a home outside Los Angeles, where he and his wife plan to settle down and escape the snow and chill of Cleveland. He'll continue to serve McGraw-Hill as consulting editor of the petroleum publications.

Replacing Mr. Platt as our publisher is Harry L. Waddell, who has been with McGraw-Hill for the last seven years. He was assistant managing editor of *Business Week* and then editor of *Factory Management and Maintenance* before coming with us last August as our assistant publisher. He has spent 20 years in gathering and interpreting business and industrial news.

Coming closer to our own personal interests, there are two editorial staff changes that took effect Jan. 1.

V. B. Guthrie has turned over the task of editing PETROLEUM PROCESSING to me, after having been at the helm since it was first started. He has been with the Platt publications 38 years. We aren't going to lose Guth's knowledge of the industry, however, and his many friends will still be seeing a lot of him. He's going to continue to be with us as associate editor—and in that position will participate actively in our coverage of the economic and management affairs of the petroleum processing industries.

As for your new editor—my sincere hope is that I'll be able to continue to build up PETROLEUM PROCESSING along the lines that have been so well established by Guth. That task isn't going to be easy, since he has set pretty high standards, and I'm counting on a good deal of assists from you readers—in the way of criticisms of what we are doing and ideas on what we should be doing.

In the long run, you know, it is you who finally determine whether or not we are doing a good job of giving you the facts and information you want, in the way in which you want them.

William F. Bland

Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The weekly oil marketing magazine, covering news, prices, transportation, storage, merchandising.

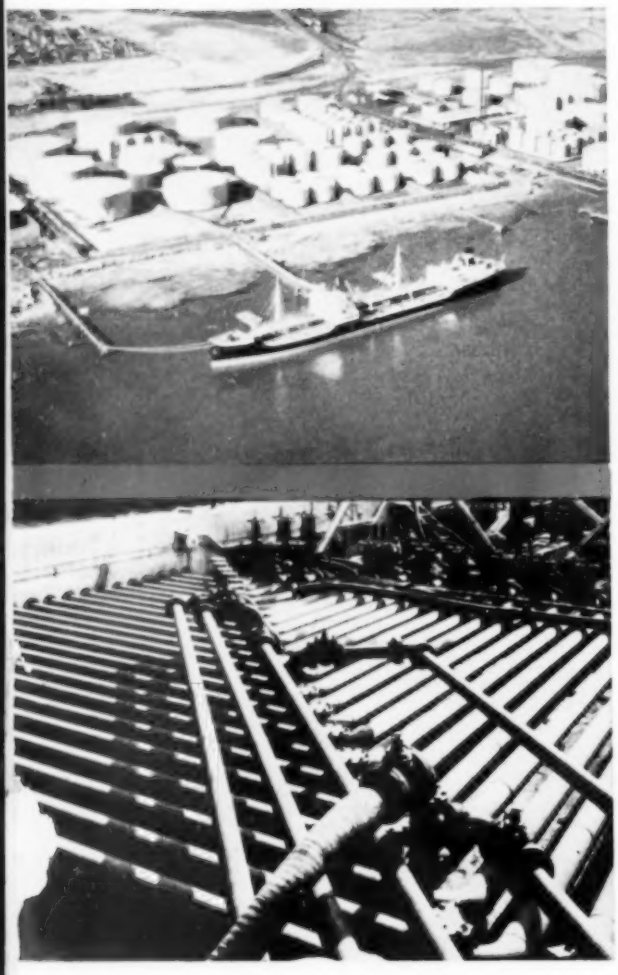
Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago and Houston.

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago and Houston.

yours to use...

HOUSTON

CORPUS CHRISTI



CHICAGO

port of NEW ORLEANS

port of NEW YORK

GENERAL AMERICAN'S tank storage terminals

In 5 great markets General American offers you complete bulk liquid storage terminal facilities with no capital investment on your part. You use modern facilities, pipelines, manifolds, blending equipment. You have complete privacy.

All methods of bulk liquid transportation are available.

At the Ports of New York and New Orleans there is high-speed canning, drumming and barreling equipment—yours to use.

for dependability, see **General American**

GENERAL AMERICAN TANK STORAGE TERMINALS
a division of GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street • Chicago 90, Illinois

TANK STORAGE TERMINALS GENERAL AMERICAN

What's Happening...

in Refinery Expansion

. . . **Operable refining capacity in U. S.** by September, 1954, will be 8,339,900 b/d, according to recent survey by American Petroleum Institute. This is an increase of 261,100 over capacity at end of 1953. These totals are exclusive of 20,500 b/d capacity which on Sept. 30, 1953, was shut down in need of major repairs but include 202,600 which, while operable, but believed to be in high cost marginal group, also was shut down as of that date.

. . . **Another new refinery for the Northwest**—A 25,000 b/d plant will be built at Tacoma, Wash., on land owned by Washington Processing Co., at costs estimated unofficially above $10,000,000. Initial throughput is planned at 10,000 b/d, and 25,000 as ultimate goal.

. . . **Standard Oil Co. of California** has reported willingness to finance a $1,000,000 asphalt plant near Sao Paulo, Brazil. Project details have not yet been worked out, company said, but would include operation, administration, and distribution.

. . . **Shell Petroleum** (London) plans construction of a 12,500 b/d catalytic cracking unit at its Geelong refinery, near Melbourne, Australia, with completion scheduled for about mid-1955.

. . . **Corpus Christi Refining Co.** has purchased 3000 b/d plant formerly operated by Inland Refining Co. at Palestine, Texas, from Byrd Oil Corp. Closed for about four months, plant was scheduled to go back on stream at year's end.

. . . **Western States Refining Co.** will build a $300,000 reforming unit at its 3000 b/d Salt Lake City, Utah, refinery, to increase octane rating of some of its gasoline. Formerly a skimming plant, firm added a thermal cracking unit last year.

. . . **Great Northern Oil Co.** now has between 1500 and 2000 acres of land earmarked for the construction of the St. Paul, Minn., area's second refinery. Negotiations are reported under way to obtain additional acreage, all in Pine Bend region of Dakota County. Projected 20,000 to 25,000 b/d refinery awaits building of a crude oil pipe line from either Williston Basin or Saskatchewan fields.

. . . **Union Oil Co. of California** has announced a new hydro-desulfurization process called "Unifining" will be built into the Oleum refinery this year as a 15,700 b/d unit. C. F. Braun & Co. has construction contract, with completion scheduled for December, 1954. Bechtel Corp. will build auxiliary facilities, tankage, and lines.

. . . **Imperial Oil Co.** has let contracts to Canadian Bechtel Ltd. to build packaging plant at Sarnia, Ont., refinery, together with warehouse and mechanical shop for centralized maintenance. Completion is expected by August, 1954.

. . . **McColl-Frontenac Oil Co.** will spend about $4,000,000 on its Edmonton, Alta., refinery to double existing capacity to 11,000 b/d. Program includes a new 3000 b/d thermal cracking unit, a 2700 b/d pressure flashing unit, additions to existing crude stills, catalytic polymerization, and fluid catalytic cracking units. The poly plant is to be doubled.

. . . **Lakota Petroleum Corp.** is making a survey for construction of $200,000 gasoline plant in Hay Creek area of Western County, Wyo. Plant is expected to process 2,000,000 CFD of gas, with liquid hydrocarbon output estimated at 10,000 b/d. Construction is expected to start in spring of this year.

. . . **Canadian Petrofina Ltd.** has concluded licensing arrangements with Houdry Process Corp. for a Houdriflow catalytic cracking unit at its Montreal refinery, with a design capacity of 20,000 b/d. The catalytic unit will be one of the major units in this completely new 20,000 b/d plant.

. . . **International Petroleum Co.,** a subsidiary of Standard Oil Co. of N. J., is building a new 45,000 b/d pipe still at its Talara, Peru, refinery, at a cost of approximately $4,000,000. Part of an overall modernization program, the new unit is scheduled for completion by Sept.

. . . **New petroleum processing plant** expansions to look for, as indicated by rapid tax amortizations announced last month:

Shell Oil Co., $57,000,000, for new 50,000 b/d refinery in Puget Sound area, Washington state.

Vulcan Asphalt Refining Co., $122,700 for relocation of 2200 b/d refinery at Cordova, Ala.

H. W. Bass, Inc., $2,893,000 for natural gasoline plant in Aransa County, Texas, with daily production of 57,525 gal. liquefied products.

Petco Corp., $1,230,000 for 4000 b/d catalytic reforming unit at Blue Island, Ill.

Union Oil Co. of California, $600,000 for 600 b/d catalytic reforming unit at Cutbank, Mont.

Hancock Oil Co., $549,190 for refining facilities at Long Beach, Calif.

Reef Fields Gasoline Corp., $274,830 for specialized isobutane facilities at East Vealmoor Field, Texas.

Mohawk Petroleum Corp., $791,000 for refining facilities at Bakersfield, Calif.

Stanolind Oil & Gas Co., $189,500 for expanded facilities at Bee County, Texas, cycling plant, to produce component for ethylene manufacture.

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

in Petrochemicals

. . . **Petroleum & Chemical Corp. Ltd.,** newly established Australian firm will build that country's first petrochemical plant. Initial production will concentrate on crude benzene, toluene, and xylene as well as fuel oil containing highly aromatic petroleum tars. Design, equipment, and technical help will be supplied by Gas Machinery Co., Cleveland, Ohio. (See "Looking Ahead," this page.)

. . . **Shell Chemical** has put its second anhydrous ammonia plant, at Ventura, Calif., into operation, using natural gas from Shell Oil's Ventura Field operations. Productive capacity is estimated at 150 ton/day. Cost was about $10,000,000.

. . . **Warren Petroleum Corp.** has shifted plans for location of new petrochemical plant from Houston ship channel to spot near Conroe, Texas, close to Midland Gasoline Co.'s LPG production. Anticipated products include methanol, acetaldehyde, and pentaerythritol. (What's Happening, June, 1953, p. 791.)

. . . **Shell Chemical Corp.** has awarded Fluor Corp. Ltd. contract for engineering, materials procurement, and construction of a new allyl chloride and chlorohydrins plant at Norco, La. Completion of the plant, the first step in Shell's current glycerin expansion program, is scheduled for late in 1954. Output will increase company's glycerin production by 25,000,000 lb./yr. and also make available substantial quantities of epichlorohydrin and Epon resins.

. . . **Sun Oil Co.** has taken first step in what is expected to be extensive petrochemicals manufacturing program in placing in partial operation its new aromatics plant at Marcus Hook, Pa. (see pp. 83-85, this issue). Plant is designed to produce annually as much as 19,000,000 gal. benzene, 19,000,000 gal. toluene, and 15,000,000 gal. mixed xylenes, using Houdriforming and Udex processes.

in Markets and Prices

. . . **Tumbling prices on a long list of refined** products highlighted December markets in the principal primary supply districts, and all indications pointed to an ample supply of oil, both crude and refined.

. . . **Swollen gasoline inventories** and slack open market demand gave rise to comment from some refiners that the bottom in gasoline prices still hadn't been reached. Warmer-than-normal temperatures over much of the area east of the Rocky Mountains kept prices for heating oils easy throughout most of December. A cold wave late in the month served to take up some of the supply slack, but consensus was that a prolonged period of "real winter" would be required to prevent surpluses in these oils from becoming "embarrassing."

Highlights of the falling prices were:

Gasoline—Gulf Coast cargo prices down 0.25 to 0.5¢ with 87 octane regular-grade quoted upward from 11¢; New York harbor barge prices for regular down 0.5¢ to a low of 12.5¢; Chicago district tank car—truck transport quotations off 0.35¢ to 12.5¢ for regular-grade. Tank wagon prices down 0.2¢/gal. throughout Eastern Seaboard states, bringing total decline since early November to 0.5¢.

Distillates—Kerosine, Diesel, and No. 2 fuel prices lower in amounts ranging up to 0.5¢/gal. in terminal markets along the north Atlantic Coast; in the Mid-Continent, discounts, from low quoted prices, of as much as 0.75¢/gal. available.

Lube Oils—Prices down 1 to 2¢ for Mid-Continent and Gulf Coast solvent refined bright stock and neutral oils, South Texas neutrals, and Pennsylvania cylinder stocks.

. . . **Heavy fuel oils were the only bright** spot of the principal refined products. In the Mid-Continent, No. 6 fuel moved up to $1.45/bbl., and prices were firm to higher in other primary supply markets.

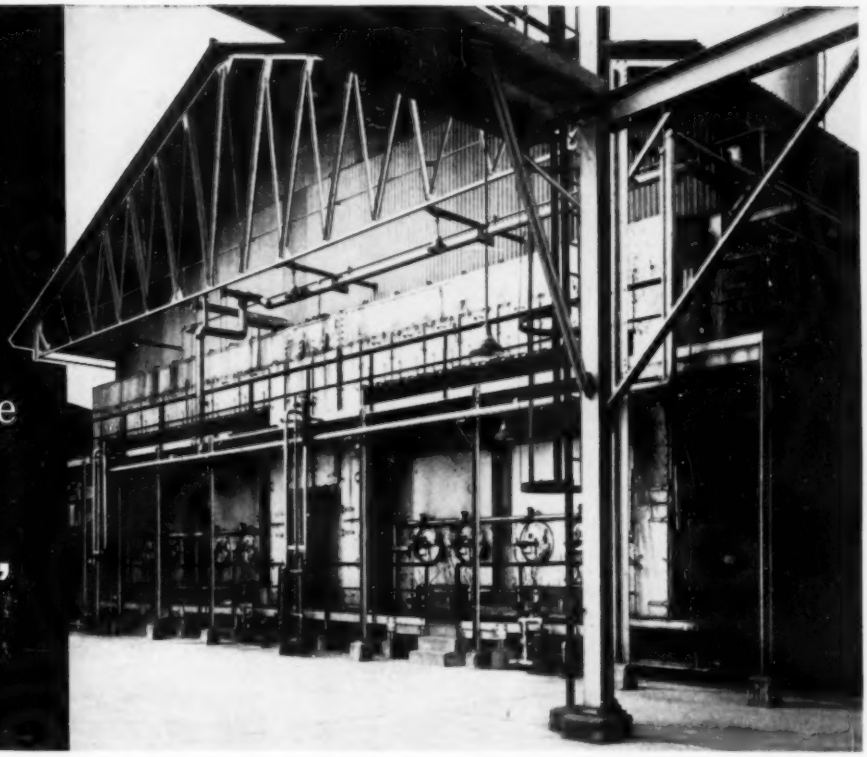
Looking Ahead

. . . **Avgas quality race** is expected to grow keener this year. Last fall, on revocation of Petroleum Administration for Defense Order No. 4, refiners reduced TEL content from 4.6 to 3 cc. Starting Jan. 1, one major is limiting lead content in his avgas output to 3 cc. With supplies now seen as "comfortable" on all grades of avgas, other refiners are expected to follow this move.

. . . **Annual demand for plastics by 1975** is seen at 9,000,000,000 lb., as against today's demand of 2,500,000,000 by Oscar A. Colten, assistant to general manager of manufacturing, Shell Chemical Co.

. . . **Large petrochemical industry** is seen for Australia with recent discovery of commercial quantities of crude oil "down under." First petrochemical plant, that of Petroleum & Chemical Corp. Ltd., has already been announced; and preliminary surveys and negotiations are now under way on several other plants, with U. S. companies showing interest in developing equipment markets.

Oil Heater Candidate For A Performance "BLUE RIBBON"



IT'S this Lummus Crude-Vacuum Oil Heater, on the job at the Paulsboro, N. J. refinery, of Socony-Vacuum Oil Company, Inc.

This unit was placed in service in November 1949. Except for a seven-day shutdown early in 1951, solely for plant considerations, *its first run was for 3½ years*. When the heater was opened it was found to be in good condition . . . with remarkably little maintenance necessary considering the unit's time in operation.

With a design duty of 83,000,000 Btu/hr., the heater during the last 3½ years has handled approximately 40% *more* than design rating. Refinery people say the heater could operate at even greater capacity.

Operating results like these at Paulsboro uphold Lummus' reputation as designers and fabricators of oil heater equipment for refineries, chemical, and petrochemical plants. In addition to superior performance, Lummus oil heater installations are marked by ease of operation and flexibility necessary to allow frequent switching of stocks.

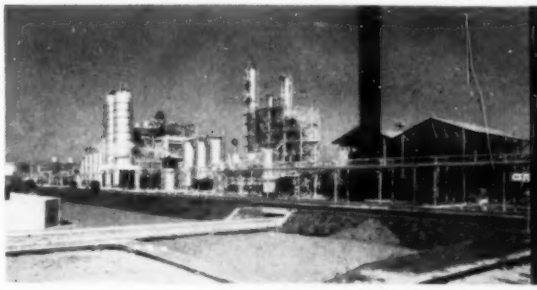
Have we suggested a few important reasons why a Lummus Oil Heater will fit into your processing picture? We'll be pleased to have our specialists talk it over with you.

THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

HOUSTON • CHICAGO • LONDON • PARIS • CARACAS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES



Across the Sea . . .

Shown at right in this photograph are Lummus Hot Oil Belt Heaters which satisfy by means of a circulating hot gas oil stream all heat requirements for the lube oil plant of a modern refinery at Dunkirk, France. This installation, as in the case of others similar to it, is characterized by a low initial investment since it eliminates a number of smaller heaters with their attendant engineering and erection costs.

(To obtain more data on advertised products see page 128)

to date ... there are 30!

Here you see a giant absorber tower of special alloy—just one of Graver's expert fabrications at Tuscola, Illinois. Already there are more than 30 Graver-built structures, including both vessels and tankage, that operate as part of this great, new multi-million dollar installation of National Petro-Chemicals Corporation.

These Graver fabrications reflect traditional Graver skill and craftsmanship. Their high quality and guaranteed performance are essential to the successful extraction of chemicals from natural gas ...in this, the largest operation of its kind in the world.

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

New York • Chicago • Philadelphia • Atlanta • Detroit • Cleveland
Pittsburgh • Houston • Catasauqua, Pa. • Sand Springs, Okla.
Casper, Wyo. • Odessa, Texas • Los Angeles

GRAVER

Process Vessels

(To obtain more data on advertised products see page 128)

Have You Thought of Catalyzing Cracking with Gamma Radiation?

INVESTIGATIONS at the University of Michigan using a 10 Kilocurie source of gamma radiation from Cobalt "60" give indications that it may not be long before radioactive materials will be found in petrochemical plants and refineries taking active part in some chemical reactions, in addition to the other tasks they now are assigned.

Most radioactive materials—radium itself, cobalt and a host of other elements—find their most common use in industry now as atomic "tags" in research investigations; for flow measurements; to locate interfaces in pipe lining operations; the measurement of liquid and solid levels and non-destructive measurement of thicknesses.

Prospects for the application of nuclear fission products to the catalysis of chemical processing reactions appear more imminent than many people believe, judging from a talk PETROLEUM PROCESSING had last month with Dr. Joseph J. Martin of the University of Michigan.

Dr. Martin is director of a research project on the "Promotion of Chemical Reactions with Gamma Radiation" being carried on at the U. of Michigan under sponsorship of the Atomic Energy Commission. That project is part of a much larger AEC program aimed at developing means of utilizing the gross fission products from the atomic reactor piles. This highly radioactive waste material is now being stored underground, pending development of methods for its utilization or disposal.

Some of the work being done at Michigan was touched on briefly by Dr. Martin during the course of a press conference on the new Nuclear Engineering Division of the American Institute of Chemical Engineers.

Gamma radiation has been applied successfully at Michigan, Dr. Martin revealed, to the catalyzing of various polymerization reactions, to the chlorination of hydrocarbons, especially the aromatics, and to other processes he didn't identify.

One polymerization reaction cited as an example was the manufacture of polyethylene, in which ethylene gas was charged to a high-pressure cylinder and exposed to gamma radiation, with the production of the polymer.

In the chlorination field, the manufacture of benzene hexachloride (the gamma isomer of which is finding wide use as an insecticide) was given as an example—with some indication of how catalysis by gamma radiation might have advantages. Present methods of producing benzene hexachloride involve exposing chlorine and benzene to ultra violet light, which promotes the reaction. The difficulty is that the reaction vessel must be built of quartz, the only practical construction material which will pass the ultra violet rays. Also, the reaction, according to Dr. Martin, takes place only in the peripheral layer of reactants next to the quartz shell, since the ultra violet rays have relatively low penetrating power.

Using gamma radiation, however, the reaction vessel can be built of steel or any suitable material, and the rays will penetrate to the very center of the reactor.

Several general advantages were indicated for gamma radiation catalysis. Since the catalyst is radiation from a source outside the reactor, there is no physical contact (in the usual sense) between the catalyst and the reactants—and therefore no need of separating the catalyst from the products. Also, it may be possible to carry out a reaction at lower temperatures and pressures, and with closer control.

According to Dr. Martin there will be no great problem in handling the fission product, properly shielded, and neither the reactants, the reaction products, nor the reactor equipment become "hot"—so that maintenance is a normal operation.

At present, all the work on the use of gamma radiation as a catalyst is being done with Cobalt 60, which has an average half-life of 5.1 years. Ultimately, it is hoped to be able to utilize the waste fission products from the atomic piles, which have an average half-life of 25-30 years. The big problem here is the safe packaging and shipping of the fission products so they can be made available to users.

Results of some of the work at the U. of Michigan will be released, Dr. Martin promises, at the Nuclear Engineering Congress to be held next June 20-25 at the U. of Michigan, under sponsorship of the AIChE and the university.

Perhaps when we learn more of the work being done we'll be thinking in terms of a catalytic cracking process in which the catalyst needs no regeneration, loses its activity only very slowly, and doesn't have to be separated from the products. It would appear to be not only possible, but probable. —D.P.T. & W.F.B.

Will Sulfur Extraction at Well be First Step in Refining Tomorrow?

THE study of sulfur compounds occurring in crude oil, which is being carried on at the Bartlesville Bureau of Mines Experiment Station under API Research Project 48A, is developing data of significance to the petroleum refiners, which may in time affect their processing techniques.

In the work on the project it became necessary to obtain some knowledge of the effect of heat on elemental sulfur and sulfur compounds present in crude oils. Test methods were developed for determining the thermal stability of the sulfur compounds present in some crudes and distillates and for studying the effect of adding elemental sulfur and tri- and polysulfides to crude oils. "As a result of these experiments," it has been reported,[1] "several interesting and possibly important reactions have been noted."

The report summarizes the knowledge which has been obtained concerning these reactions: Some crude oils contain elemental sulfur; some containing only sulfur compounds react similarly in some respects to those containing elemental sulfur. The elemental sulfur begins to react with some components of the crude at about 200-300° F., with the evolution of hydrogen sulfide. This reaction reaches its maximum observable rate at about 400° F., accompanied by rapid evolution of

the hydrogen sulfide and rapid depletion of the elemental sulfur content.

Approximately 50% of the elemental sulfur can be accounted for by the hydrogen sulfide evolved at 400° F. The remaining sulfur forms thermally labile compounds that decompose at above 400° F., releasing hydrogen sulfide. Tri- and polysulfides react with components of crude oil similarly to elemental sulfur in that hydrogen sulfide is formed, but they also form thiols in much greater quantity than does the equivalent amount of elemental sulfur. Asphaltic constituents of crude contain thermally labile sulfur compounds that decompose to yield hydrogen sulfide at 500° F. and above.

"There are some implications from this work that relate to the refining of crude oil," the report summarizes. "Obviously, if a crude oil contains polysulfides and even though no thiols are originally present, upon distillation at a temperature of 400 or 500° F., thiols will be produced and a sour distillate obtained. The reaction of crude oil constituents with sulfur to yield hydrogen sulfide suggests the possibility of field treatment for certain crude oils in which the elemental sulfur content is high.

"If it were economical to heat these crude oils in the field in a closed system to 400° F. a considerable portion of the sulfur would be released as hydrogen sulfide, and this reaction would not occur in costly refinery equipment where it might cause more serious replacement problems. Possible removal of the elemental sulfur as such from the crude oil before any heat treatment is worthy of thought."

Extraction of sulfur from crude at the wellhead would raise some economic as well as technical questions. Heating the crude to dispel the hydrogen sulfide would also discharge volumes of gas. If it were classified as natural gas it might come under the jurisdiction of the state conservation authorities and venting be prohibited. Disposal of the gas with its hydrogen sulfide content might create problems, but hardly as severe as when the hydrogen sulfide is removed at the refinery. Removal at the well would take advantage of the heat in the crude as it comes to the surface.

It is to be hoped, as the API Research Project 48A staff suggest, that means will be found to study further the reaction of sulfur, polysulfide and hydrocarbons in crude at atmospheric pressure. Therein might be found the answer to some of the refiners' sulfur removal problems. —V. B. G.

(1) "Thermal Stability of High-Sulfur Crude Oils", H. J. Coleman, C. J. Thompsin, H. T. Rall and H. M. Smith, Bureau of Mines Petroleum Experiment Station, Bartlesville, Okla. Preprint of paper presented before Division of Petroleum Chemistry, American Chemical Society meeting, Los Angeles, March 24—April 1, 1953.

Here's a Chance to Experiment With Coal Carbonization Tars

LOW-TEMPERATURE carbonization of coal and lignite has long been thought by some petroleum researchers as offering the best route for converting such materials to liquid fuels—rather than via hydrogenation.

In the carbonization process, coal or lignite is heated to 900-1200° F. and decomposed to yield four main products—semi-coke or char; complex, partially oxygenated liquid hydrocarbons or tar; fixed gases, and water.

The char is the primary product, and has use as a fuel, for blending metallurgical coking coal and for gasification to produce synthesis gas for chemical purposes.

Petroleum interest has been in the tars—as a possible source of both liquid fuels as substitutes for conventional petroleum fuels and of organic chemicals of the type now widely manufactured from petroleum hydrocarbons.

Stumbling block so far has been that there's no large scale commercial use of low-temperature carbonization in this country—and therefore little data on just what can be expected in the way of tars.

That situation may be corrected soon. The Texas Light and Power Co., acting as agents of the Aluminum Co. of America, is building a 240,000 kw generating plant at Rockdale, Texas, to supply power to Alcoa's new primary aluminum plant there. Initially the generating plant will use dried lignite (mined locally) as fuel. Eventually it may use char from low-temperature carbonization of the lignite.

A prototype carbonizer has been developed and will be operated several months to prove the design and engineering facilities and to produce tar for research and market studies, according to information presented at the annual American Institute of Chemical Engineers meeting by V. F. Parry of the Bureau of Mines.(1) Experience from this operation will indicate the probable economics and optimum design for a complete carbonization plant.

The prototype unit will yield large enough quantities of tar to permit large scale research investigations of its chemical composition, processing susceptibility, products obtainable, and uses and markets for the products.

Preliminary pilot plant investigations of the possible tar products from the operation have been carried out by the Bureau. These indicate that about a third of the tar consists of high-boiling tar acids, with most of the remainder being neutral oils. The neutral oils, when distilled under vacuum (40 mm. Hg abs.) yielded 40% olefins, 41% aromatics and 19% paraffins. Next step is to learn what these olefins, aromatics and paraffins are, what influences their production, and what can be done with them.

Petroleum processing people interested in exploring the probabilities of working with these tars could probably make arrangements to secure experimental quantities. Although we can't visualize (at this point) a refinery carrying out the carbonization process, it does seem a logical place to process the tars into fuels and chemicals.

There's one big drawback we see to the possible widespread use of tars from low-temperature carbonization as a source of substitute liquid fuels. The char would probably continue to be the primary product and the tar a secondary by-product—just as the tar from coking, and subject to the same limitations of supply. —W.F.B.

(1) "Low-Temperature Carbonization of Coal and Lignite for Industrial Use," by V. F. Parry, U.S. Bureau of Mines, presented before American Institute of Chemical Engineers, St. Louis, Mo., Dec. 13-16, 1953.

Products of fame

wherever there's flame...

Keeping flame on the job is the business of brick. Refractory brick to contain the flame and put it to work with efficiency and economy in the furnaces of industry.

Grefco refractory products have long been famed for doing this job reliably. Grefco brick, special shapes, mortars, plastics and castables to hold the heat and help spew out products for the service of industry.

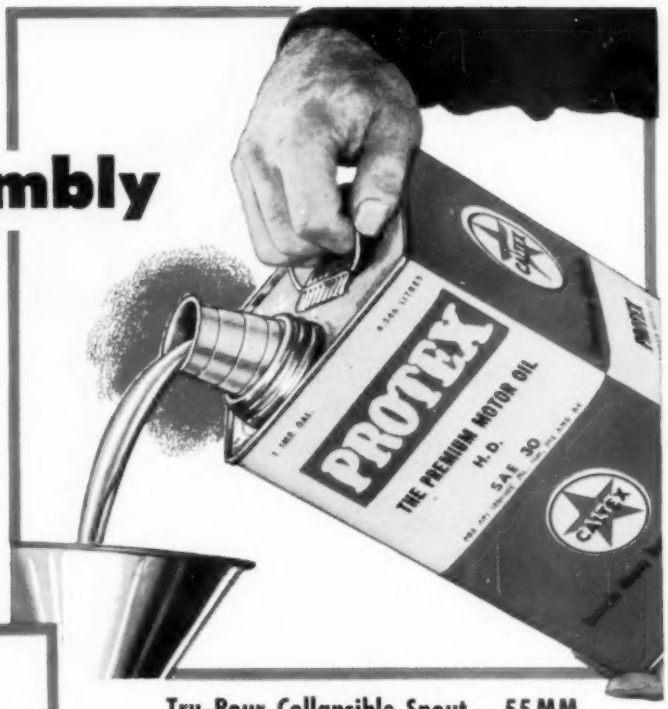
If your operation requires *flame*, here's the name . . . *Grefco!*

A Complete Refractories Service . . .

GENERAL REFRACTORIES COMPANY
Philadelphia

GENERAL REFRACTORIES COMPANY

Tri-Sure®
Tru-Pour Assembly
makes packing and pouring
easy

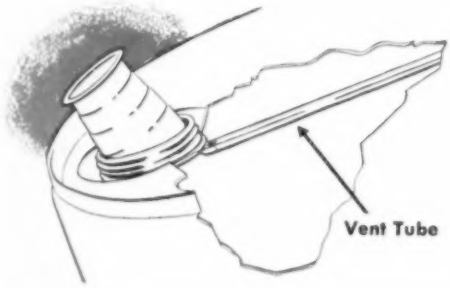


Tru-Pour Collapsible Spout — 55 MM Nozzle Assembly for Upressit Cap
Filling opening, 1¼"; pouring opening, 1⅜".

Screw Cap
Available plain or lithographed, complete with liner.

Inner Seal

Tru-Pour Collapsible Spout — 2¼" Screw Nozzle Assembly
With or without base to accept vent tube.
Filling opening, 1¼"; pouring opening, 1⅜".



The Tri-Sure* Tru-Pour Assembly provides a leak-proof closure that protects your product in transit and greatly facilitates handling, pouring and packing.

This closure features a collapsible spout which can be quickly extended to direct the flow into an opening, and instantly folded so that pails can be easily stacked. Assembled with a 2¼" screw nozzle or a 55 MM nozzle for Upressit Cap, for containers of 1 to 12 gallon capacity.

If you ship liquid products in light containers, the Tri-Sure Tru-Pour Assembly offers you an opportunity to improve your packaging and increase the good-will of your customers. Ask your container supplier now for full details, and write to us for illustrated literature on the complete line of Tri-Sure Container Closures—Screw Caps, Nozzles, Spouts and Assemblies that meet every requirement for security and ease of handling.

Tri-Sure Container Closures comply with I.C.C. and C.R.C. specifications.

**The Tri-Sure Trademark is a mark of reliability backed by over 30 years serving industry.*

Tri-Sure
Reg. U. S. Pat. Off.

CONTAINER CLOSURES

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Tri-Sure Products Limited, St. Catharines, Ontario, Canada

Letters

Not the First One

To THE EDITOR: In the October, 1953, issue of PETROLEUM PROCESSING (p. 1565), a photograph with a small caption was published in which it was stated that Mr. Sixto Acuna, of the Philippines, is believed to be the first chemical engineer from that country to take up practical training in the U. S. in the field of petroleum processing.

According to the writer's best knowledge, the first Filipino chemical engineer to receive actual training in petroleum processing was Mr. Severo Amagna. After receiving his Master's degree in chemical engineering from the Massachusetts Institute of Technology in 1951, he was employed by the California Texas Oil Co., Ltd., where he worked in their New York office for one year before he was sent to Holland and later to Bahrein to complete his training. Mr. Amagna is now back in the Philippines and is holding a responsible position with Caltex (Philippines), Inc.

It is worth mentioning that Caltex is the first and only company to put up a refinery in the Philippines.

In order that competent Filipino engineers may handle future operations of the Caltex refinery, the company is at present training five engineers in their New York office, all of whom are U. S. college graduates. These are Domingo Y. Angeles, chemical engineer (Carnegie Institute of Technology), Vicente R. Garcia, chemical engineer (also Carnegie Tech), Alfonso Padua, civil engineer (Yale), Constante Ventura, mechanical engineer (Illinois Tech), and Felix Limcaoco, electrical engineer (Cornell).

The above-mentioned engineers will receive the last phases of their training in Rotterdam, Holland, prior to their return to the Philippines.

VICENTE R. GARCIA

240 West 73rd St.
New York 23, N. Y.

• *Thank you, Reader (and trainee) Vicente Garcia.* PETROLEUM PROCESSING *was glad to learn that Mr. Acuna, of Sun Oil Co., was not a lone wolf in accumulating States-side "know-how," for use in his homeland. It goes almost without saying that the more engineers from across the seas that are trained in American industrial techniques, the sooner will modern*

Do YOU have operations similar to these?

Then check the extra savings possible with industry's great new profit-builder –

Arnold O. Beckman OXYGEN CONTROL!

Where others are cutting costs, boosting profits...

- **Boilers, Direct Fired Heaters or Stills, Rotary Kilns**
  Arnold O. Beckman Oxygen Measurement on Flue gases insures greater savings through optimum combustion efficiency, lower fuel costs.
- **Hydrogenation, Hydrofining, Gas Compressors, Sulfur Grinding**
  Arnold O. Beckman Oxygen Control in explosive atmospheres protects lives, prevents costly damage, reduces fire risks.
- **Air Liquifraction, Production of Acetylene, Butadiene and Similar Gases**
  Arnold O. Beckman Oxygen Measurement insures higher product quality through minimum oxygen or air contamination.
- **Resin Kettles, Color Pigments, Product Storage**
  Arnold O. Beckman Oxygen Measurement of inert purge systems minimizes oxidation, protects product standards.

Send For This Helpful Data–

BULLETIN 103: *Describes the Model G-2 Beckman Oxygen Analyzer — the instrument to use where maximum accuracy is essential. Model G-2 ranges are available for oxygen concentrations as low as 0-1000 parts per million — as high as 95-100% — or virtually any other range or combination of ranges. Bulletin 103 describes the unique magnetic operating principle used in Model G-2 Analyzers, equipment, accessories and typical applications.*

BULLETIN 108: *Describes the Model F-3 Beckman Oxygen Analyzer —the instrument designed primarily for industrial applications such as combustion control, catalyst regeneration, sulfur grinding, etc., which require an oxygen measuring range of 0-5%, 0-10%, 0-15% or higher. Bulletin 108 describes the unique magnetic operating principle used in Model F-3 Analyzers, gives equipment specifications and typical applications for this instrument.*

BULLETIN AD607: *Contains helpful charts and data on most efficient methods of controlling various combustion processes.*

BULLETIN AD608: *Outlines savings to be made with oxygen control in Cat Cracking operations, gives sampling suggestions and list of equipment.*

BULLETIN AD612: *Describes gas monitoring system for gas plants and compressor stations, shows sampling arrangement, lists equipment required.*

BULLETIN AD701: *Describes a sampling system particularly suited for Cat Cracker applications . . . includes illustration of equipment layout.*

Want more details?

In addition to the applications highlighted above, there are many other processes where Arnold O. Beckman Oxygen Control brings new profits, new savings, new production efficiencies. Write for additional information, outlining your particular field of operation.

Arnold O. Beckman INC

1020 Mission St., South Pasadena 22, California

Please send Bulletins checked below:

☐ 103 ☐ 108 ☐ 607 ☐ 608 ☐ 612 ☐ 701

Name _____

Company and Address _____

_____

_____

Position _____

(To obtain more data on advertised products see page 128)

for dependable, trouble-free control
"of hard-to-hold" fluids . . . . .

SPECIFY
HOMESTEAD
Lever-Seald
VALVES

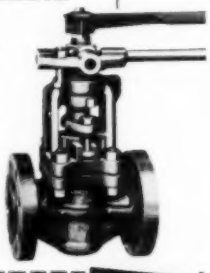
they provide sure shut-off . . .

ARE STICK PROOF . . . OPERATE INSTANTLY

A positive, drop-tight seal and instant, stick-proof operation under all fluid, temperature or pressure conditions, is assured by the exclusive, built-in, Homestead Lever-Seald mechanism. This powerful lever-and-screw device not only presses the valve's tapered plug firmly into its seat to form a drop-tight seal, but also provides a positive means of relieving seating pressure just enough to overcome friction and permit easy operation. And because all operating parts and valve seating surfaces are fully protected in both the open and closed positions from the corrosive or erosive effects of line fluids, long, dependable, trouble-free service is doubly assured.

If "hard-to-handle" fluids are your problem, specify Homestead Lever-Seald Valves for your next installation or as replacements. You'll be glad you did.

We make them in metals and alloys to specification in sizes 1⅛" to 12", for pressures from vacuum to 1500 lbs., and for temperatures from 40° below zero to 1100°F. Dry seat, or pressure gun lubricated optional.



For complete details and copy of VALVE REFERENCE BOOK No. 39-3, MAIL THE COUPON TODAY.

Without obligation, send me Catalog 39-3 covering Homestead Lever-Seald Valves.

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ STATE_____

HOMESTEAD VALVE MANUFACTURING COMPANY
Serving Since 1892
P. O. Box 43 Coraopolis, Pa.

business skills and technology have a chance to raise the living standards of other nations.

Combination Processing

NOTE: In last month's issue, Reader Paulus of Standard Oil Co. (Ind.) commented on the article "Combination Processing Can Cut 22% Off Investment Costs" (October, pp. 1505-1510), with considerable interest. He brought out that as a result of careful study his own company has designed its new 30,000 b/d refinery for Mandan, N. Dak., to embody combination crude running, catalytic cracking, vapor recovery, and catalytic polymerization.

He anticipates a widespread adoption of combination processing and a gradually increasing trend toward complete refinery integration. For a somewhat different viewpoint, readers will be interested in the following comments.

TO THE EDITOR: There is no doubt the article [on combination processing] provokes good thinking. It is bound to create varied expressions of opinions. It has been the experience of our company that combination units lack flexibility. We have had experience with one large combination unit built prior to the war and as a result we have never been prompted to build another such unit. Changes in crude demands made upon the plant, we think, require flexibility which combination units do not permit.

Even though there may be some economy, both in capital and operating costs, our present thinking prompts us to follow unit processing procedure.

W. R. ARGYLE
Sinclair Refining Co.
New York, N. Y.

TO THE EDITOR: . . . your article on combination processing . . . contains considerable thought-provoking material, and I found it very interesting.

It appears to me that the combination unit fits ideally in a situation where it can always feed the same type of crude. Designing such a unit for wide variations (in crude gravity, for instance) might well wipe out most of the savings.

In general, streamlining of operations is a worthwhile objective, and the industry will no doubt continue to move in that direction.

O. N. MILLER
General Mgr., Mfg. Dept.
Standard Oil Co. of Calif.
San Francisco, Calif.

(To obtain more data on advertised products see page 128)

PETROLEUM CHEMICALS DIVISION

NEWS

January ★ One of a Series of Interest to the Petroleum Industry ★ 1954

New Bronze Gasoline Dye Available from Du Pont

The mixing of several gasoline dyes to obtain a desired color has long been an inconvenience to refiners.

Simplify Operations

If you have had this problem in creating a bronze color, it will now be easy to simplify your dye addition operations. Du Pont Oil Bronze makes this possible.

The new Du Pont bronze dye is a free-flowing powder that can be easily handled in dry eductor systems as well as in any other commercial method of gasoline dye addition.

Highly Soluble

Oil Bronze has a total solubility in synthetic gasoline of 4500 grams of dye per 100 U.S. gallons. Speed of solution is extremely rapid.

This new bronze dye is ready for shipment in standard 100-pound containers . . . also in 50-pound, 25-pound and smaller size packages. Samples and full details on Du Pont Oil Bronze are available from any Du Pont Petroleum Chemicals Division representative or district office listed on back page.

BRIEFCASE PRESENTATION PACKAGE

For those desiring a nutshell version of the presentation described in the feature article at right, miniature lube oil show kits are available.

The flannelboard itself measures 9½ by 13¾ inches. In spite of its compactness, the miniature presentation can be clearly and easily read.

Small enough to be stuffed in a briefcase—with room to spare, they can be easily carried wherever your salesmen go. And they take only a few seconds to set up for an informal desk-top presentation.

If you would like to examine one of these miniature boards, your Du Pont representative can obtain one for you.

New Tool to Help Dealers Promote More Frequent Oil Changes

Unique lube oil show designed by Du Pont is personalized to point up quality features of your own motor oil

The need for frequent oil change—and the value of this service to the car owner—represents a real profit opportunity for your dealers. But getting them to see this opportunity . . . and to *do something about it* . . . has long been a major problem for marketing executives.

IT WILL BE EASY FOR YOUR DEALERS to understand from this flannelboard presentation that "good oil seldom wears out . . . but it can become dirtied to death." Also, that *it pays to change oil frequently.*

To help stimulate your dealers to go after this market, Du Pont has developed a new lube oil show. The theme is "good oil seldom wears out . . . but it can become dirtied to death."

Visual-Aid Tool

The show can be easily presented by any oil company representative. To make it simple, clear-cut and easy to understand, the presentation is built up progressively on a flannelboard. This unique and highly flexible visual-aid technique permits the presentation to be specially tailored to fit any oil company's individual needs.

The Plot

The theme of the presentation is developed to bring out the following points.

Typical lubricating oil molecules must perform five important functions all at once. They must lubricate, protect, cool, seal and clean.

In doing these jobs, good oil seldom wears out in the engine. But even the

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

JOHN F. SHAW

Assistant Central District Manager

JOHN F. SHAW was recently appointed assistant manager of the Petroleum Chemicals Division's Central District.

Previous to this assignment, he was a sales supervisor in the Division's West Coast District. He joined the Du Pont Company in 1947.

Mr. Shaw graduated from the University of Texas in 1934 with a B.S. degree in Mechanical Engineering. His first job after college was with the Reed Roller Bit Company. He later became chief engineer of this company's tank transmission plant.

In 1944 he joined the Crum-Brainard Company as chief engineer. There he was in charge of design and manufacturing operations of oil well drilling tools. He then joined the Waldrip Engineering Company as chief design engineer.

Mr. Shaw is a member of the American Society of Mechanical Engineers and the American Petroleum Institute.

CONTINUED *"Lube Oil Show"*

best oil eventually becomes *dirtied to death*—by acids, dust, carbon, metal, gum and dilution. And it must be changed.

Adding more clean oil is of little help. Clean oil added to dirty oil makes just one thing—more dirty oil.

Low-Cost Insurance

The speaker delivering the presentation can emphasize the fact that frequent oil changes are cheaper than engine repairs . . . and in the best interest of the customer.

Thus, a dealer can promote his oil change service as a low-cost insurance policy on the life of the car owner's engine. To help him do this, the lube oil show supplies him with a variety of powerful, easy-to-remember selling points.

Personalized For You

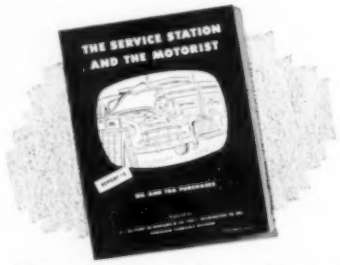
The individual points emphasized in the presentation can be personalized to bring out the special quality features of your own brand of motor oil.

A complete script – which can be easily varied to fit the speaker's own presentation style – is supplied with each flannelboard kit. This too, can be personalized to dramatize your own important sales points. Detailed instructions for presentation are also included with the kits.

If you are interested in having one of these personalized lube oil presentations made up for use in your own dealer meetings, we suggest that you talk over the details with a Du Pont Petroleum Chemicals Division representative.

Oil and TBA Purchase Habits Studied in Du Pont Survey

Report No. 5 in Du Pont's continuing study of service station customer buying habits is now being distributed to oil company marketing executives.



This report covers the purchase patterns in oil and TBA items. Like the other reports in the series on gasoline buying habits, and brand and dealer loyalty, this report is based on 3,100 household interviews and 21,000 observations at 1,193 service stations. The survey is national in scope.

Who Buys Oil Where

Of all the motorists surveyed, 74% buy their motor oil at the same place they buy gasoline. The remaining 26% buy oil from a variety of sources – mainly other service stations, car dealers and mechanics' garages. A much smaller percentage purchase at chain stores, mail order houses and from "friends who get it for them."

Brand preference was the chief reason given for purchasing oil at sources other than the regular gasoline supplier. Superior service, convenience and personal friendship were also mentioned as reasons.

Among motorists who have a favorite brand of motor oil, the survey found that quality belief is the chief factor in their choice.

TBA Merchandising

From actual observations, it was found that for every 200 customer stops at service stations, only one of these produced a tire sale. However, it was also observed that only one out of every 1,000 customers was *offered* tires by station attendants. Buying habits for batteries and oil filters are also included in the latest survey report.

It is expected that this Du Pont survey will be extremely valuable to oil company marketers for pinpointing oil and TBA merchandising opportunities . . . and in developing plans to capitalize these opportunities.

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas — Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd. — Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue — Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. — Phone PReston 2857
LOS ANGELES, CALIF.—612 So. Flower St. — Phone MAdison 1691

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

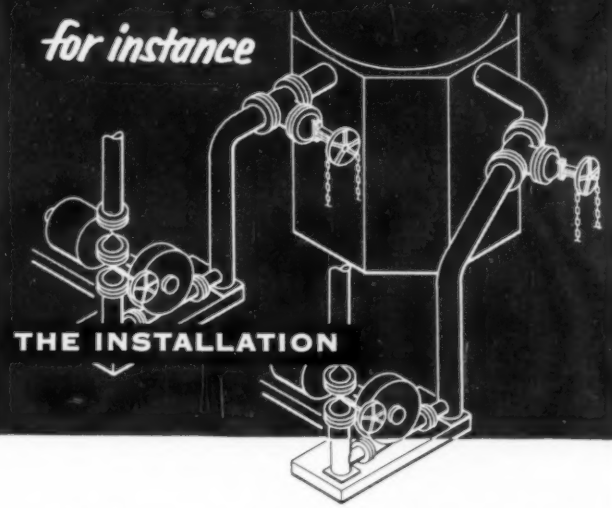
ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-6504

Printed in U.S.A.

You're Sure of Tighter Seating with Crane Steel Gates

...in a Butadiene Plant, for instance



THE INSTALLATION

At a Southwestern butadiene plant, using Crane 18-inch steel gate valves on suction lines from extractive distillation towers to pumps. Working pressure, 90 psi, 250 to 300 deg. F.

VALVE SERVICE RATINGS

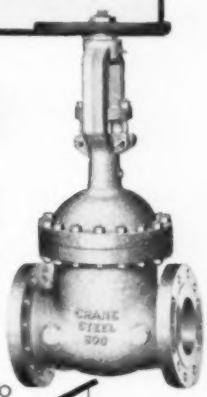
SUITABILITY:	Have what the job takes
FEATURES:	Epelloy seating
MAINTENANCE COST:	Zero
SERVICE LIFE:	Installed 1951 - long life ahead
OPERATING RESULT:	Valve efficiency restored
AVAILABILITY:	Catalog item — No. 33X

THE CASE HISTORY

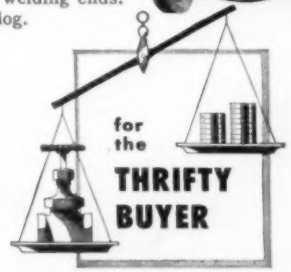
Original valves in this service were lubricated plug valves, but they couldn't be made to seat tightly on the light hydro-carbons and furfural mixture. Their continual leakage burdened the plant with excessive maintenance, and a constant threat to process control. All these lubricated plug valves were replaced with Crane 33X steel wedge gate valves.

Installed more than 2 years ago, the Crane valves completely remedied the leakage trouble, and to date, none have required any maintenance whatsoever. They keep working perfectly with but prescribed routine care.

THE VALVE



Product of pioneer skill in steel casting, and with a long record of service to petroleum and petrochemical industries, Crane steel valves stand apart from the ordinary. Yet they actually cost less for service delivered. Choose from the widest range of body and trim materials; in all pressure classes, sizes; flanged, screwed, or welding ends. See your Crane Catalog.



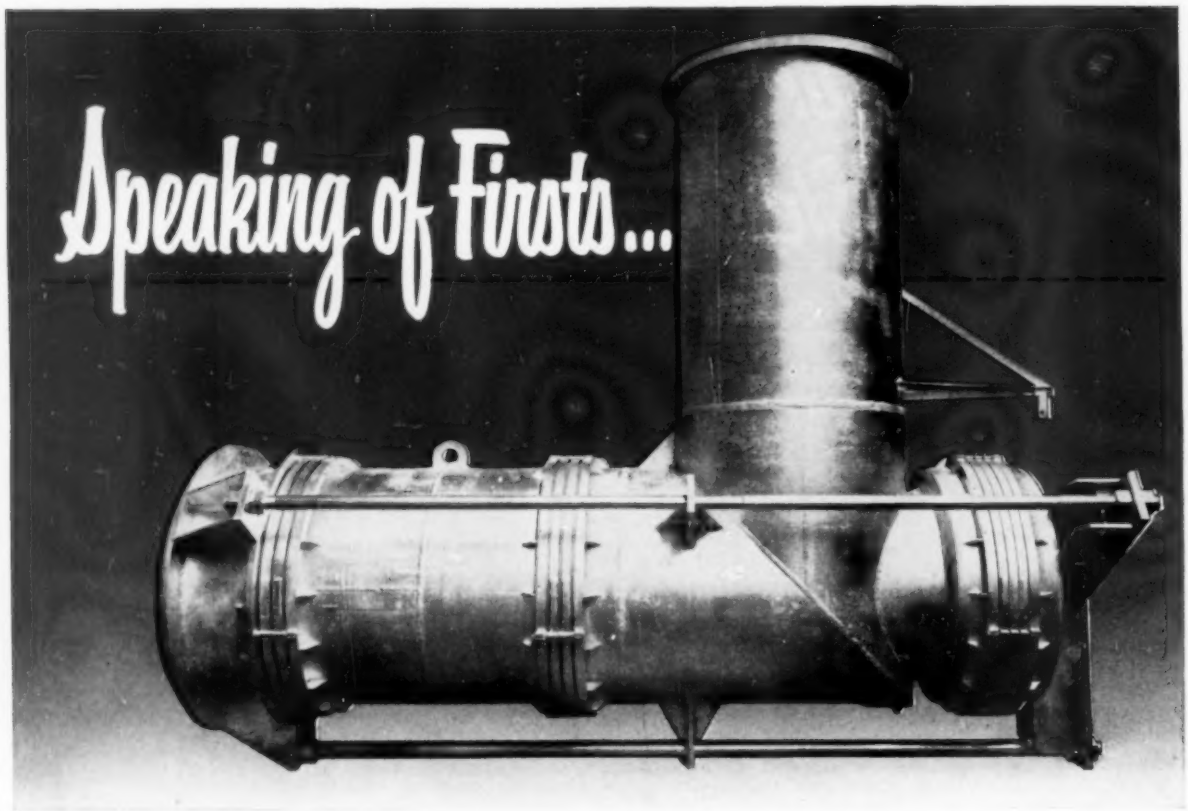
THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



Recently, Zallea was given the assignment of developing a group of 48-inch expansion joints for flight propulsion test facilities on a classified defense project. The rigid technical specifications of this advanced application required "tailor-made" units for the job, so Zallea engineers analyzed the problem and designed the unusual-looking joint pictured above . . . the first of its kind. Actually, it is a Balanced Pressure, Universal Self-equalizing expansion joint, originally developed by Zallea engineers in 1945, operating at 165 psi and incorporating internal stainless steel turning vanes to provide a smooth flow of gases through the right angle bend. The unit absorbs 3" axial and 1.27" lateral movements through a temperature range from −100° F. to +650° F. No anchors are required since this arrangement neutralizes end thrust developed by internal pressures.

This example is representative of our ability to cope with the most difficult expansion joint problems. It is our business to specialize in the design and manufacture of one product only—expansion joints—and over the years we have learned how to solve the "tough ones" effectively and quickly.

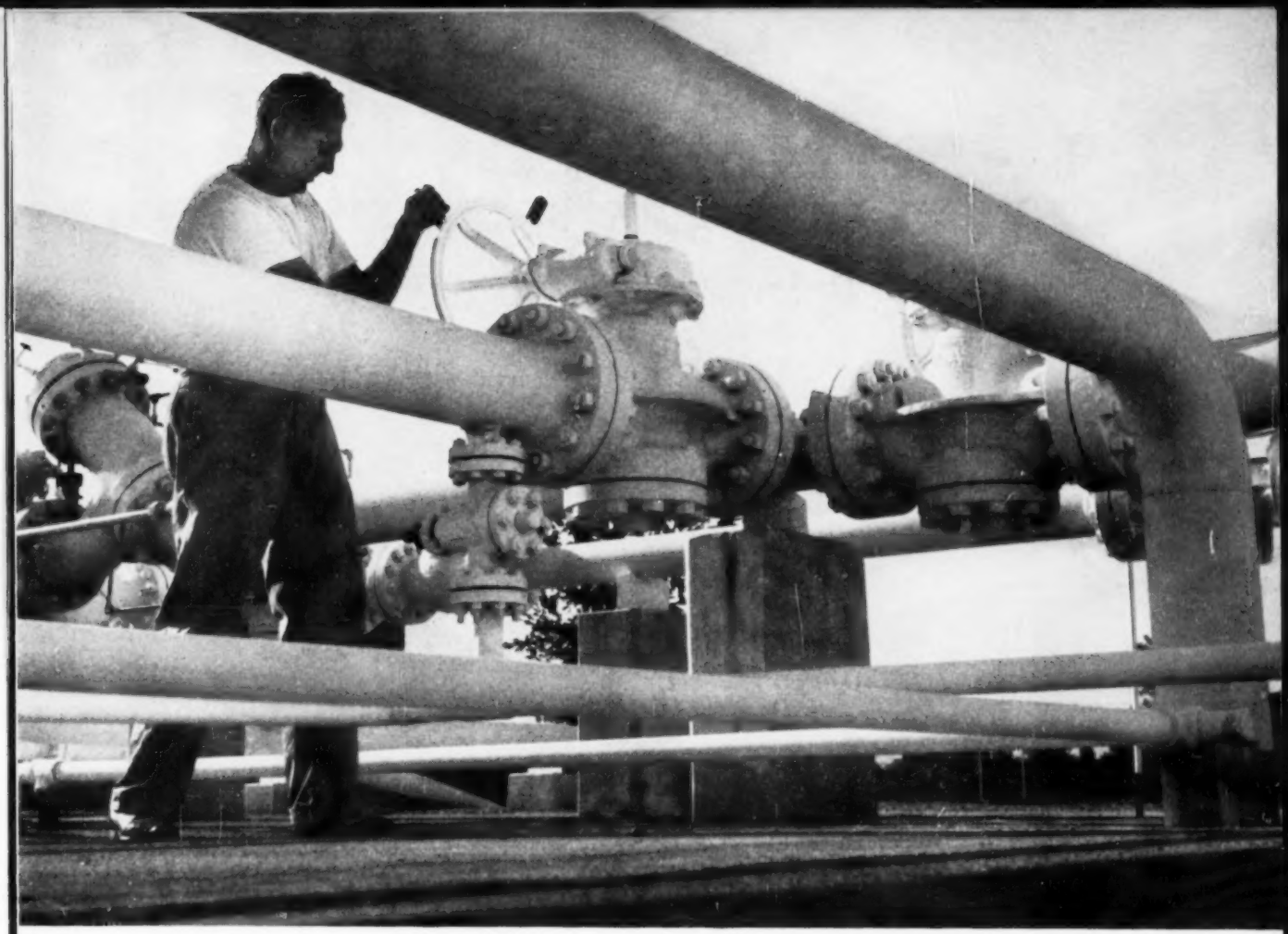
Zallea Expansion Joints are available in diameters from 3 inches to 30 feet . . . for temperatures from sub-zero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs, and up to 2,000 psi in special designs.

The next time you are faced with an expansion problem, get in touch with us. We will be glad to survey your situation and recommend the most practical and economical solution. Zallea Brothers, 822 Locust Street, Wilmington 99, Delaware.

For detailed information on Zallea Expansion Joints and services write today for a free copy of Bulletin 351.

Zallea
EXPANSION JOINTS

 (To obtain more data on advertised products see page 1936)



Why **ROCKWELL-**Nordstrom **VALVES** *are First Choice*

IN THE REFINING AND PROCESSING INDUSTRIES

Thousands of Rockwell-Nordstrom valves are installed on refining and petroleum processing lines. The reason for the success of Rockwell-Nordstrom valves on these services is that their lubricant-sealed closure gives a tighter shut-off than is possible with any other type of valve.

And Rockwell-Nordstroms last longer, too. Protected by a film of lubricant, the seating surfaces are never exposed to the line fluid, never subjected to the metal-to-metal abrasion so common in ordinary valves.

Also important is the fact that Rockwell-Nordstrom valves are ready to operate easily no matter how long they have remained in one position.

For further information on Rockwell-Nordstrom valves for refinery and processing services, call your Rockwell representative or write Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Licensee: Peacock Brothers Limited.*

ROCKWELL-Nordstrom **VALVES** *Lubricant-Sealed for Positive Shut-Off*

RINGS. *Sizes:* From 3/32" I.D. x 3/16" long x 7/32" O.D. to ½" I.D. x 1" long x 1" O.D.

PELLETS. *Sizes:* From ⅛" x ⅛" to ½" x ½".

SPHERES. *Diameters:* ¼" to 1".

Rx for shorter contact time!

Norton specially engineered carriers bring proved advantages to a wide range of processes

Whatever your specific application may be, it will pay you to investigate the many advantages of Norton catalyst carriers.

Made of ALUNDUM* (fused alpha alumina), these highly refractory carriers are outstanding for heat conductivity, chemical inertness, mechanical strength and abrasion-resistance. And Norton's exclusive *controlled structure* process offers you a choice of porosities. In pellets and rings, porosities range from medium to high. In spheres, porosities range from medium, with rough exterior for coating with catalyst... to high, with a network of open pores and rough exterior for impregnating with catalyst.

Chemical engineers are finding this Norton "Special Refractory Prescription" invaluable in processing many different products. For example, in meeting the rapidly growing demand for phthalic anhydride, Norton catalyst carriers aid in shortening catalyst contact time and in achieving the highly exothermic reaction in fixed bed converters.

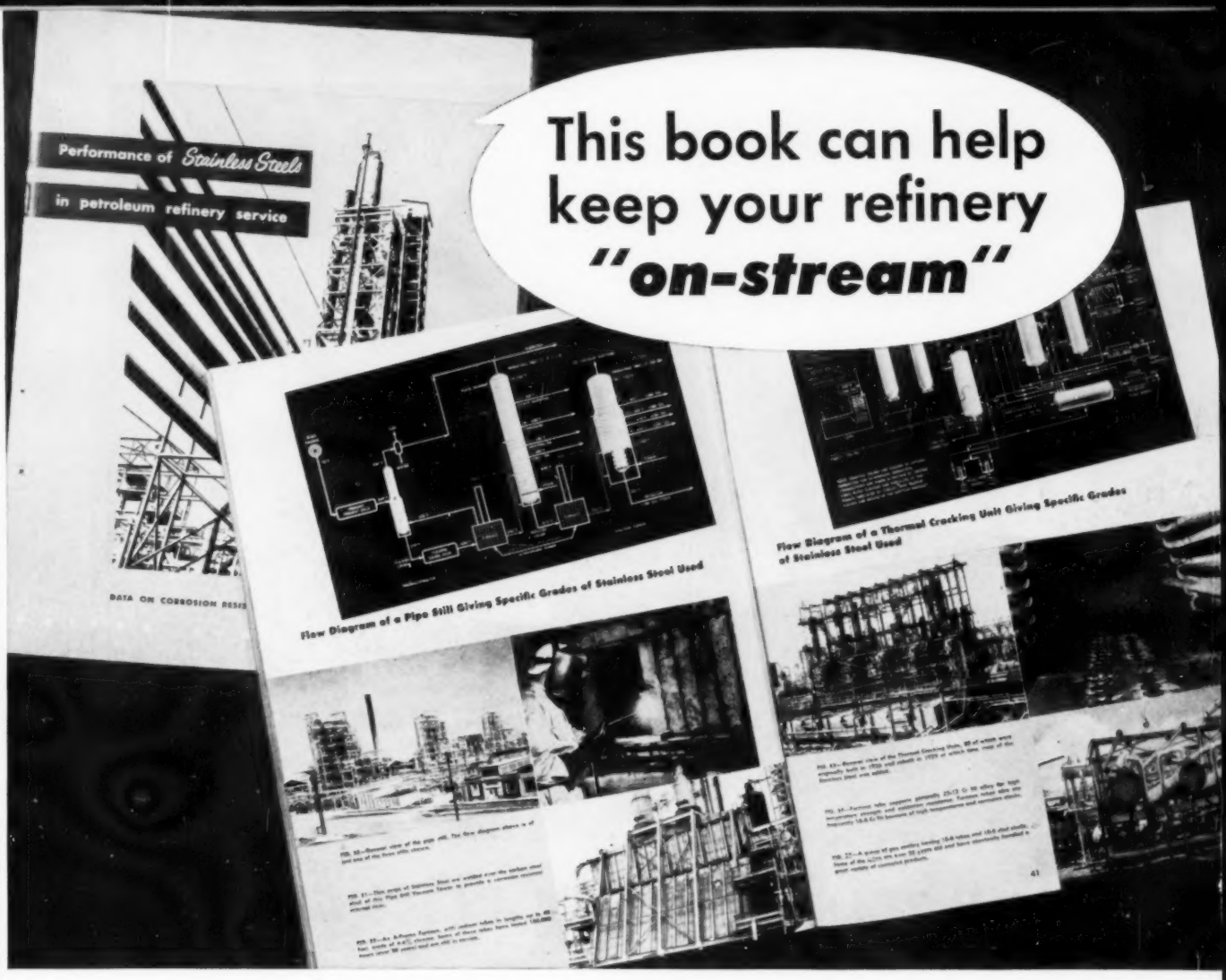
Test Them Out

Find out just what Norton ALUNDUM catalyst carriers can do for you. See your Norton Representative for samples, or write to NORTON COMPANY, 260 New Bond Street, Worcester 6, Mass.

Canadian Representative: A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
REFRACTORIES
ENGINEERED Rx PRESCRIBED
Making better products... to make other products better
NORTON COMPANY, WORCESTER 6, MASSACHUSETTS


Performance of Stainless Steels
in petroleum refinery service
This book can help keep your refinery "on-stream"
Flow Diagram of a Pipe Still Giving Specific Grades of Stainless Steel Used
Flow Diagram of a Thermal Cracking Unit Giving Specific Grades of Stainless Steel Used

SEND FOR YOUR FREE COPY

With Stainless Steel playing such an important role in your never-ending fight against down time, here is just the information you need to use this valuable material most effectively.

It's United States Steel's new book, "Performance of Stainless Steel in Petroleum Refinery Service." Based on the actual experience of some of America's largest refineries with Stainless Steel, it presents one of the most comprehensive studies ever made of application of Stainless Steel to the petroleum industry.

It discusses fully all types of corrosion—atmospheric, wet chemical, elevated temperature and such forms of intergranular corrosion as carbide precipitation, attack by molten metals and sulphur attack.

It presents strength data on 14 of the grades of U·S·S Stainless Steel most frequently used in high temperature service.

And, finally, it gives you flow diagrams of processes in use in major refineries, showing exactly where Stainless Steel is used. These processes include Thermal Cracking Units, Lube Oil Extraction Plants, Pipe Stills and Fluid Catalytic Cracking Units.

Your copy is ready. Use the coupon below.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

4-65

UNITED STATES STEEL

United States Steel Corporation,
525 William Penn Place, Room 4221,
Pittsburgh 30, Pa.

Please send me my copy of "Performance of Stainless Steel in Petroleum Refinery Service."

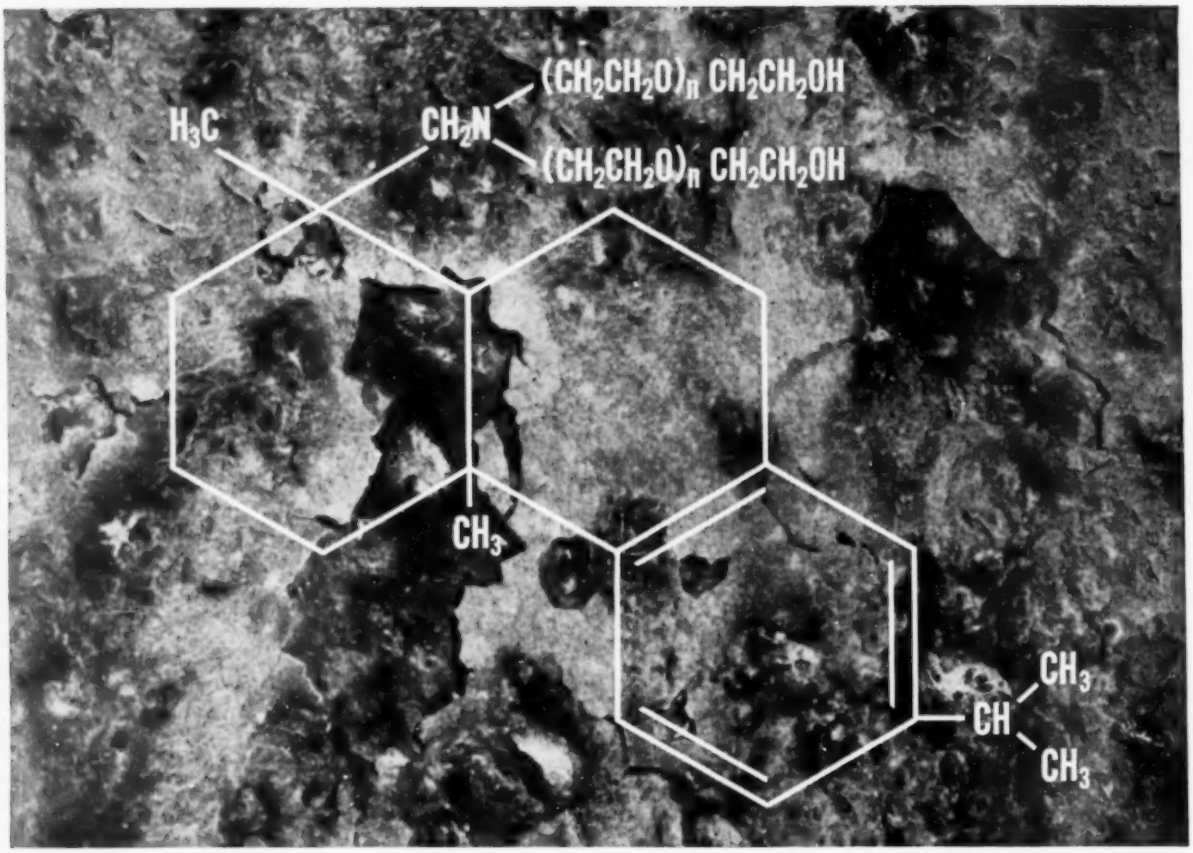
Name .....

Title .....

Company .....

Address .....

City ..... State .....



ACID CORROSION IN REFINERIES CONTROLLED WITH POLYRAD

New Chemical Inhibitor Also a Detergent

Internal corrosion and plugging of refinery equipment are controlled with Polyrad 1110-A, a new inhibitor developed by Hercules research. Now in use in a number of refineries, Polyrad helps maintain throughput, increases heat transfer, reduces metal loss, and cuts shutdown time and repairs.

Polyrad is a derivative of an organic amine. Its chemical nature is shown above. When injected into refinery equipment, it forms a molecular film that shields metal surfaces from hydrogen-ion attack by organic and inorganic acids.

Polyrad 1110-A, used in refinery equipment, is unique in that it has a detergent action. It loosens iron sulfide and other scales, permitting them to be dispersed in the fluid stream and removed at the water separator or product receiver.

This new inhibitor is designed to function efficiently under acid conditions. For example, at low concentrations it gives better than 99 per cent protection to mild steel immersed in strong hydrochloric acid. It can also be used in conjunction with ammonia or other alkalies. Polyrad has proved to be effective up to 500°F.

Polyrad 1110-A is readily available. Stocks are carried at convenient locations for prompt shipment. For further information, send for Technical Service Bulletin No. 189.

Naval Stores Department

HERCULES POWDER COMPANY

INCORPORATED

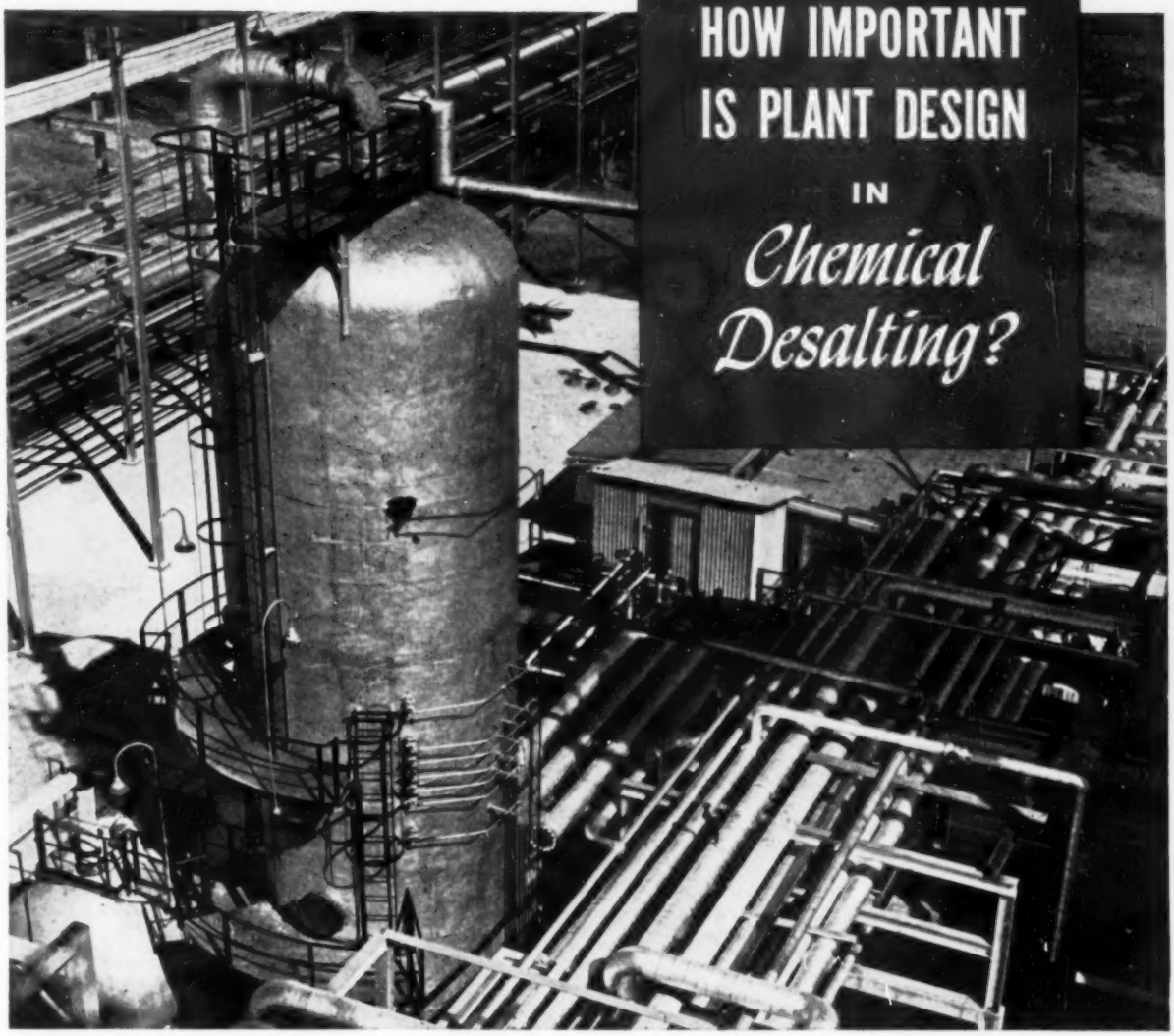
984 King Street, Wilmington 99, Del.

POLYRAD®

A Hercules Rosin Amine Derivative

NA53-1

(To obtain more data on advertised products see page 128)



At Tretolite, we believe plant design is almost as important as the selection of an effective desalting chemical. We also believe, and can cite many years of wide-spread Tretolite usage to prove our point, that we make the best chemical desalting reagents obtainable. At the same time, we know that to be completely effective, a desalting chemical must be properly used, in a correctly designed desalting plant. That is why the Tretolite Company offers a complete desalting service, from preliminary tests through plant completion, and from there on.

We firmly believe we *sell* the best desalting chemicals on the market. We know we *give* a desalting service that is unequalled in the chemical field. Don't be satisfied with less.

TRETOLITE COMPANY

Chemicals and Services
for the Petroleum Industry

SAINT LOUIS 19, MISSOURI • LOS ANGELES 22, CALIFORNIA

DESALTING • DEHYDRATING • CORROSION INHIBITING
SCALE PREVENTING • WATER DE-OILING
PARAFFIN REMOVING

TD 53-3

 (To obtain more data on advertised products see page 128)

Profit-building **answers** *to* ***MODERN***

results of

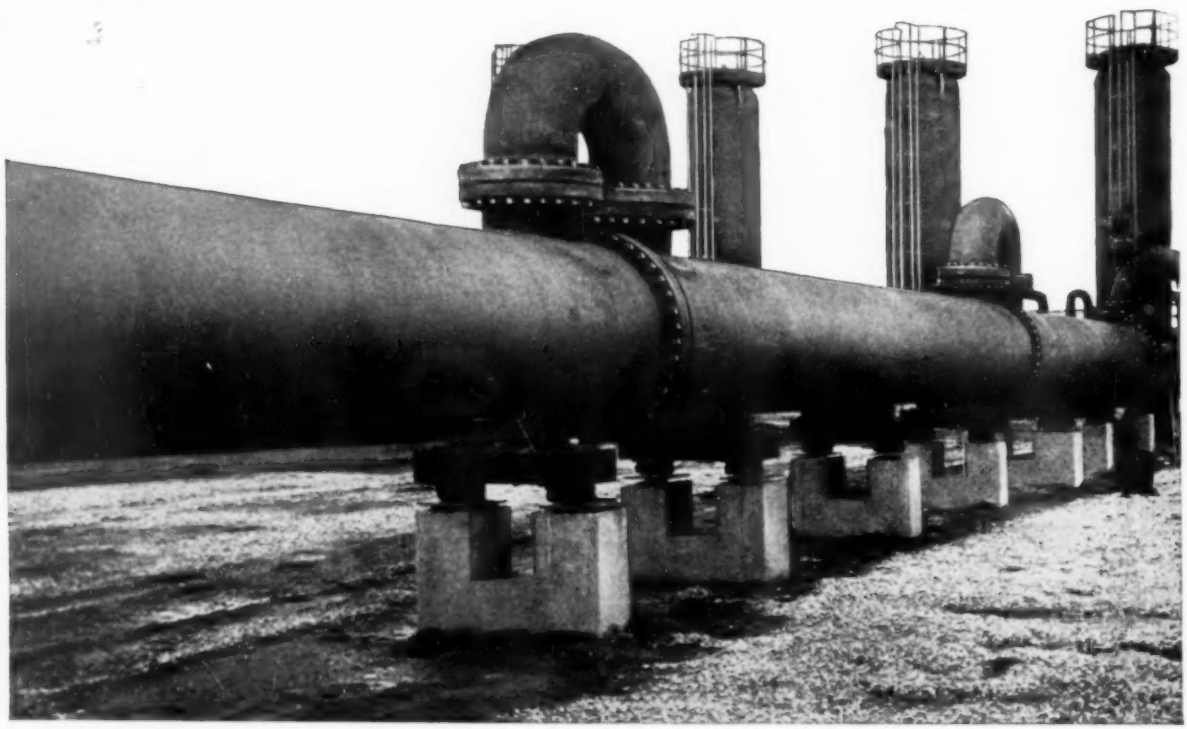
Alco EXPERIENCE

...gained through many years of designing and building heavy-metal equipment for refining and processing companies the world over.

and

Alco FACILITIES

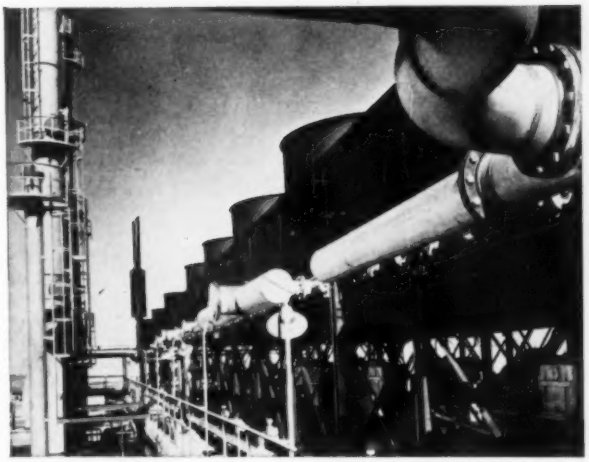
...capable of handling economically an extremely wide range of metal-fabricating operations...of meeting strictest customer specifications.



150 FT "TRAIN" HEAT EXCHANGERS, designed and built by Alco with special flange-to-flange construction, step up efficiency at Tennessee Gas Transmission Company's huge gas processing plant at Gabe, Kentucky. Other Alco units at Gabe include ethylene flash drum, demethanizer tower, primary feed cooler.

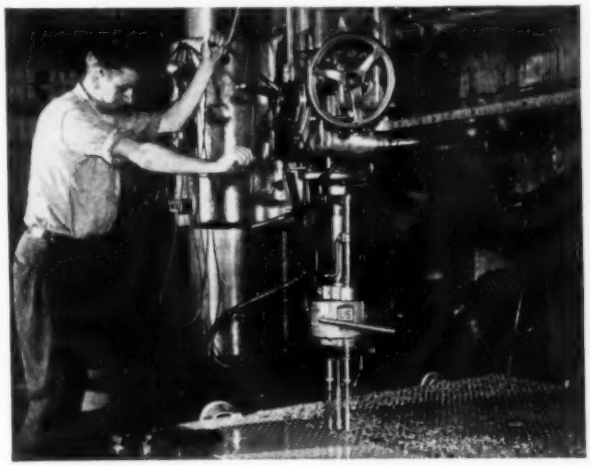
PROCESSING problems

...examples of the wide variety of heavy-metal equipment designed and built by Alco to meet today's demands in petroleum and petrochemical processing.



SPECIAL ALCO AIRCOOLERS, with many components of aluminum and stainless steel, handle 80 percent of cooling load at Celanese Corporation's new 630-acre petrochemical plant at Pampa, Texas. Units have removable headers and slide-out tube bundles, operate in constant presence of highly corrosive acids, chemicals and gases.

PRIMARY AND ATMOSPHERIC TOWER CONDENSERS, plus stabilizer condenser, naphtha cooler, kerosene and diesel oil exchangers, are among the many Alco units at Canadian Oil Refineries' new $23,000,000 plant at Sarnia, Ontario. This plant produces more than 115,000,000 gal. of gasoline annually, claims first catalytic reformer in Canada.



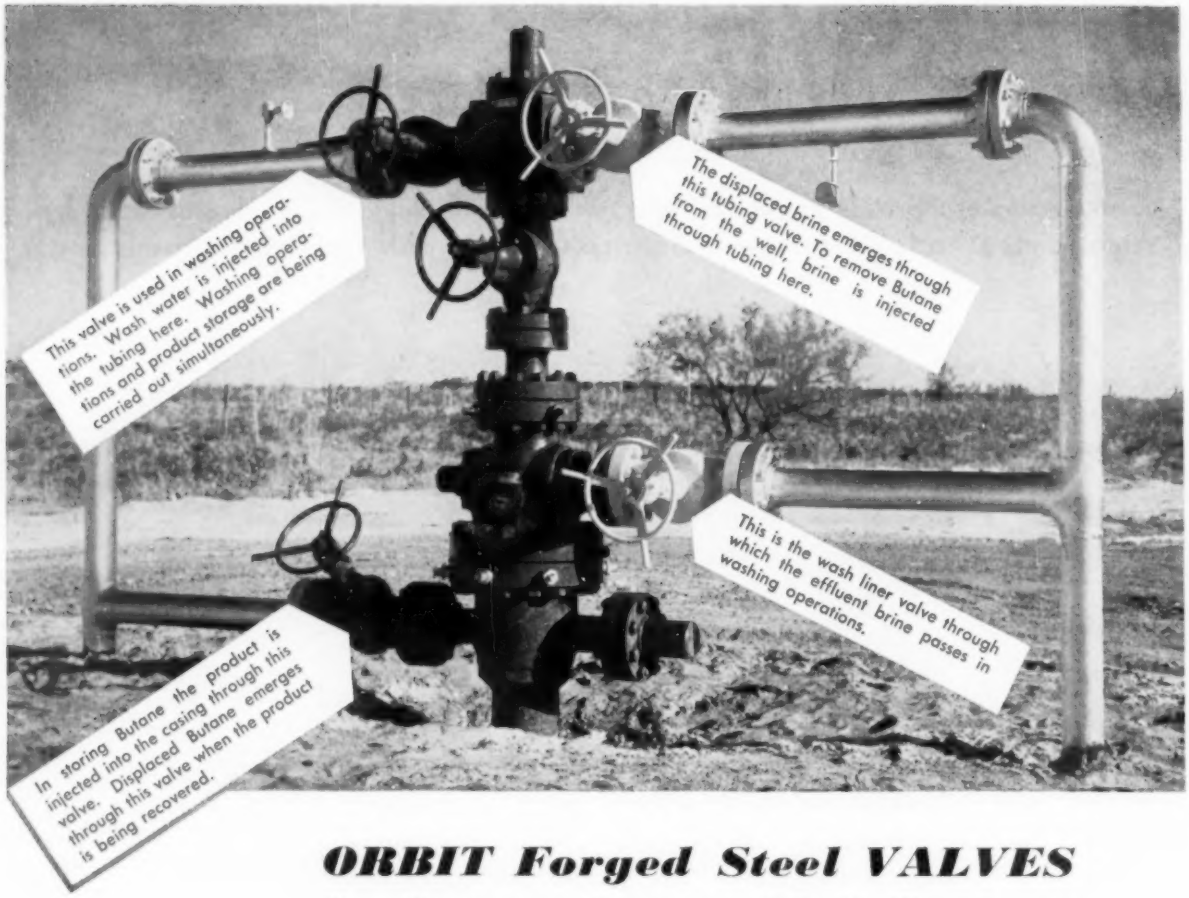
EIGHT FOOT RADIAL DRILL at Alco's modern, completely equipped plant at Dunkirk, N.Y., has multiple head for the precision drilling or reaming of several holes simultaneously. Unique facilities like this, many of them Alco designed, enable Alco to fabricate dependable, profit-building answers to toughest processing problems.

Let Alco facilities and experience produce profit-building answers to your processing problems. Contact your nearest Alco Products sales representative today. Offices in Dunkirk, New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa and Beaumont.

ALCO

ALCO PRODUCTS DIVISION

AMERICAN LOCOMOTIVE COMPANY · DUNKIRK, NEW YORK


This valve is used in washing operations. Wash water is injected into the tubing here. Washing operations and product storage are being carried out simultaneously.
The displaced brine emerges through this tubing valve. To remove Butane from the well, brine is injected through tubing here.
This is the wash liner valve through which the effluent brine passes in washing operations.
In storing Butane the product is injected into the casing through this valve. Displaced Butane emerges through this valve when the product is being recovered.

ORBIT Forged Steel VALVES

On Butane Storage Well Hook-up

A familiar sight these days — wherever you see hydrocarbon ground storage operations you see Orbit Forged Steel LP Gas Valves being used.

Orbit valves have proved themselves in LP gas service and are known and accepted by operators as being a reliable, safe component in processing, handling and storage of hydrocarbons.

ORBIT VALVES ®

Orbit Forged Steel LP Gas Valves are available in sizes: 1″, 1½″, 2″, 2½″, 3″ and 4″ ASA ratings beginning at 150 lb., to and including 2500 lb. flanged and screw end, full opening, carbon steel trim or stainless steel trim. Maximum rated working temperature 250 degrees Fahrenheit.

ORBIT VALVE COMPANY

P. O. BOX 699 **TULSA, OKLAHOMA**

• BRANCHES •

HOUSTON, TEXAS
407 Velasco
(Serving the Gulf Coast)

CASPER, WYOMING
1740 E. Yellowstone
(Serving the Rocky Mountain States and Canada)

ODESSA, TEXAS
402 West County Road
(Serving West Texas)

these steam traps won't freeze up!

This outdoor installation of Yarway Traps and Strainers in New Mexico gas plant completely eliminated freeze-ups.

Freeze-ups of outdoor steam traps in winter weather often cause production delays. Don't take that chance . . . especially when it's so easy to install Yarways, the steam traps that *won't freeze up.*

They won't freeze because condensate does not accumulate. The only moving part—a little valve—is continually testing for condensate, discharging it as soon as it forms. There's never anything to freeze.

Other reasons why over 850,000 Yarway Impulse Steam Traps have been sold—they get equipment hotter, sooner; light weight; small size; easy to install and maintain; good for all pressures; made of stainless steel.

More than 200 industrial distributors sell Yarway Traps and Strainers. See your nearest one today. For name, and free 24-page Steam Trap Book, write . . .

YARNALL-WARING COMPANY
153 Mermaid Lane, Philadelphia 18, Pa.

YARWAY

the steam trap designed with more production in mind

 (To obtain more data on advertised products see page 128)

PSC furnishes 300 styles of BUBBLE CAPS and RISERS

in Any Metal

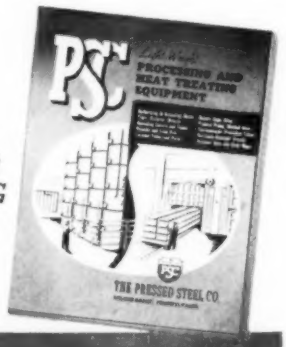
- **ALUMINUM**
- **BRASS**
- **COPPER**
- **NICKEL**
- **STAINLESS STEEL,** any chrome-nickel or straight chrome type
- **STEEL,** carbon

...and Without Die Cost

Being entirely unassociated with any metal producer, PSC regularly fabricates the complete list of ferrous and non-ferrous metals and alloys normally available today. At PSC you can order processing equipment in the one particular metal which best meets your specific heat and corrosion requirements. Service records of fractionating towers, for instance, show that this PSC advantage repeatedly results in better life/cost ratios of bubble caps. Quotations on alternate metals are always available at PSC.

With dies on hand for about 300 standard styles of bubble caps and risers, PSC is in a position not only to save many customers the cost of dies but also to save them design and delivery time. PSC bubble caps are furnished for all methods of tray assembly. Special caps furnished to order. Send blue prints or write as to your needs. You will find, we believe, the largest compilation of engineering data on bubble caps and risers in PSC catalog 52.

Send for Process Equipment CATALOG 52



THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

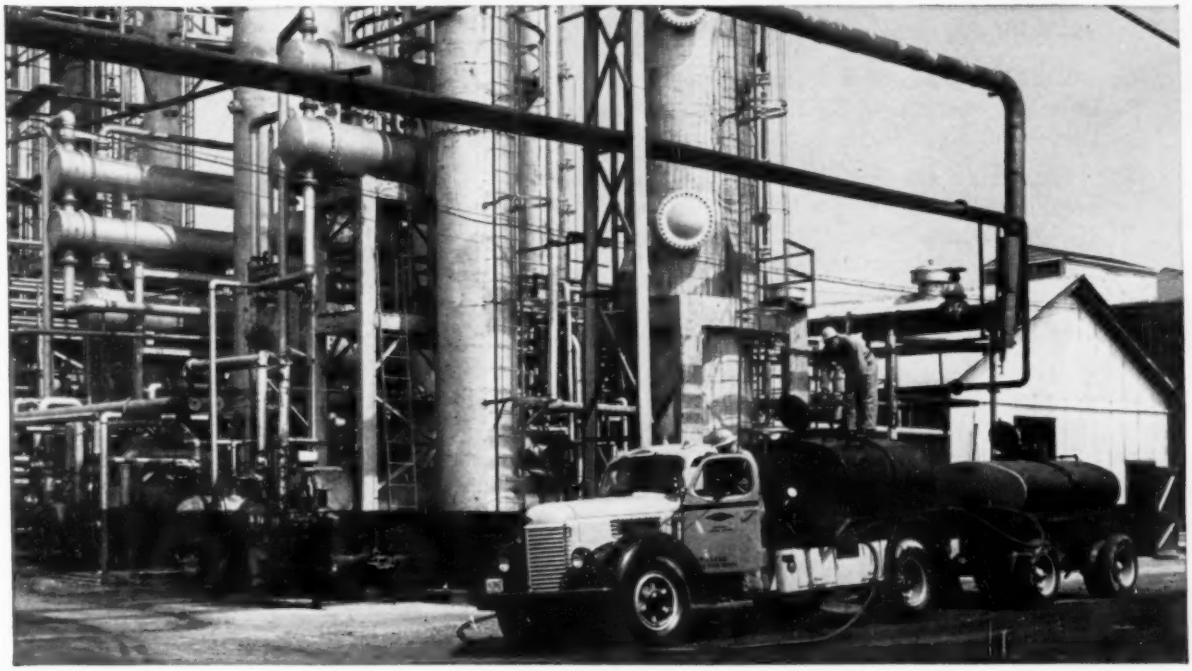
Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

(To obtain more data on advertised products see page 128)

HEAT EXCHANGER EFFICIENCY RESTORED BY DOWELL SERVICE

Scale deposits removed by chemistry without dismantling equipment . . . without production shut-down



When scale and sludge accumulate on your heat transfer equipment, there's bound to be a reduction in efficiency with an increase in operating costs.

The Dowell method of removing scale and sludge *by chemistry* has been accepted by thousands of plant operators as a fast, safe and economical way to help restore efficiency to equipment.

Dowell was recently called upon to clean three badly fouled heat exchangers in a refinery. Dowell engineers pumped liquid solvents into the areas of the exchangers to be cleaned. Then, after sufficient reaction time, the spent solutions were flushed from the units, along with the sludge accumulations. After cleaning, one unit could carry the load previously carried by all three.

The Dowell method is fast and economical because solvents are pumped into equipment through regular connections without dismantling. Many types of equipment can be cleaned while in operation. No special devices or rig-ups are needed. It's efficient, too, because these solvents reach wherever steam and water flow. Even the most complicated heat transfer surfaces—angles, curves, piping—have been cleaned effectively in this manner.

Furthermore, Dowell furnishes the trained personnel, the truck-mounted tanks, pumps, heaters, mixers and control equipment to do the job.

What's *your* cleaning problem? Dowell engineers will be glad to talk with you about better, faster and more economical ways to clean your equipment. Contact your nearest Dowell office today. Or, write directly to Tulsa, Dept. A-32.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED · TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

(To obtain more data on advertised products see page 128)

Why is "Lead" used to control Sulphuric Acid Corrosion?

For centuries "Vitriol" was hard to harness.

But in 1746, Roebuck of Birmingham found how to tame this workhorse of the chemical industry. He used lead.

Lead is still the first metal to look to for control of sulphuric acid corrosion. It's basic in producing H_2SO_4. It's basic in handling H_2SO_4. It's basic in concentration, recovery and storage of H_2SO_4.

Lead should come first to mind in the control of corrosives because:

1 **Lead makes and wears its own protective armor.** Repairs it, too. In contact with H_2SO_4 (and many other acids) it makes for itself an impervious, insoluble, self-mending coating which only an abnormal condition destroys.

2 **Lead cooperates when it is fabricated.** No common metal is easier to work. Even in the field you can easily melt and cast it . . . mold and shape it . . . cut or form it. You can "burn" (weld) lead to lead with simple equipment. You can bond it to steel or copper.

3 **Lead is economical and available.** Its cost per pound is low. It costs little to maintain. When its application has run its course, lead has high salvage value...often a substantial percentage of original metal cost.

WHAT GOES FOR LEAD AND H_2SO_4 GOES FOR LEAD AND HUNDREDS OF OTHER CORROSIVES

When you think of Lead . . . think of National Lead

National Lead puts lead in your hands in all the grades and forms you may require. National Lead provides all common mill shapes and sizes and forms . . . sheet, pipe, fittings, valves. Or you can have National Lead "tailor-make" lead equipment for you.

So put National Lead first in your thinking when you want to combat corrosion. Call on National Lead for technical assistance. Ask for a copy of the new booklet on "Chemical Lead Products."

National Lead Company

New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Co. of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Toronto, Canada (Canada Metal Company, Limited).

*Reg. U. S. Pat. Off.

(To obtain more data on advertised products see page 128)

Follow the Leaders . . . specify

GRAPHIC PANELS

by FOXBORO

COMBINATION UNIT CONTROL PANEL for a Standard Oil Company (New Jersey) Affiliate. The panel makes full use of compact, full-visibility Foxboro Consotrol Recorders and Recording Control Stations located in the process diagram for easy operation and trend analysis.

Here and abroad, leading manufacturers are saving time and money by utilizing Foxboro's expert panel engineering facilities to provide them with Graphic Panels of outstanding efficiency and appearance.

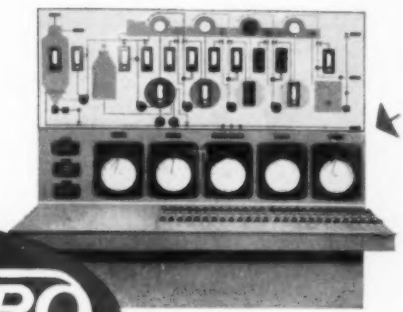
Specialists in the field, Foxboro will engineer and fabricate a Graphic Panel exactly to your specifications —or will design one directly from your flow sheet. And they will recommend the most practical instrumentation and arrangement.

The Graphic Panels shown here are typical of the many now in operation throughout the world.

Write for detailed information on Foxboro Graphic Panels; also Bulletin 471 on Consotrol Instrumentation.

The Foxboro Company
911 Neponset Ave., Foxboro, Mass.

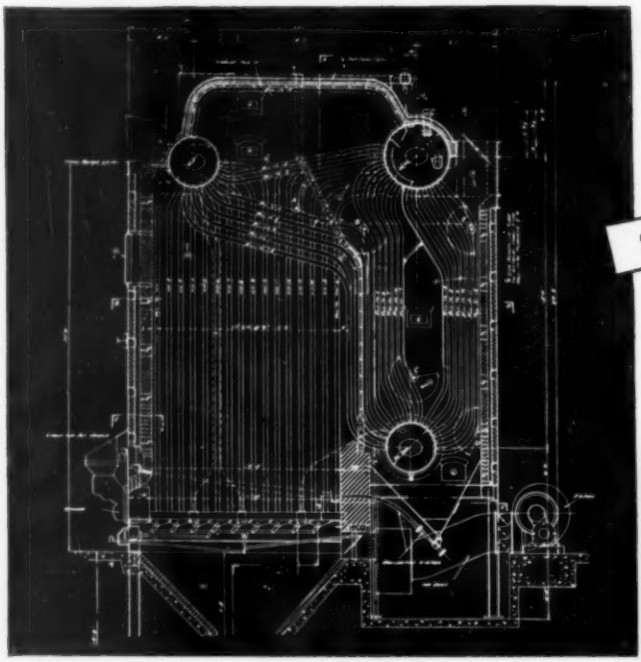
ALKYLATION UNIT CONTROL PANEL for Standard Oil Company of Ohio. Uses both Consotrol and standard size instruments. All critical controls are within immediate reach . . . all operating adjustments conveniently accessible from front of panel.



GRAPHIC PANEL for Gaylord Container Corp. controls four-stage vacuum pulp wash. Indicating type control instruments are located in the process diagram. Operation records appear on pneumatic 6-point Circular Chart Recorders located below related instruments in diagram. Normal and emergency operating controls and signal lights are neatly arranged on panel desk for easy identification.

FOXBORO
Reg. U. S. Pat. Off.
PROCESS CONTROL ENGINEERING

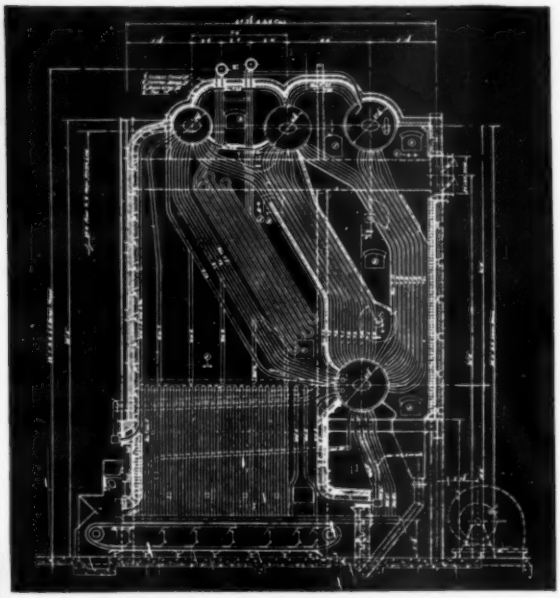
Quick Steaming at all Ratings!



Carry high overloads with high efficiency

SPECIFY **Vogt**

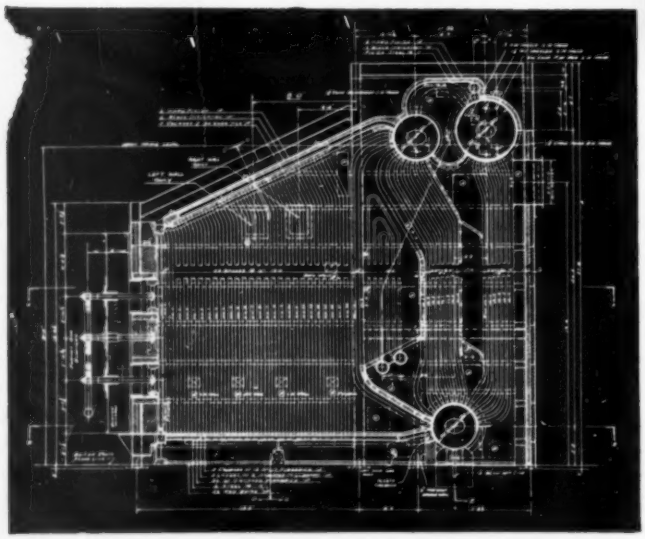
STEAM GENERATING UNITS



CLASS VL — Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE — Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR — 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

(To obtain more data on advertised products see page 128)

New Crude Distillation Towers at SOHIO's Cleveland No. 1 Refinery. These twin 3-stage units are 130 feet high, 13 feet O.D.; handle 22,500 bbl. per day each. Monel linings limit corrosion in upper sections. Fabrication by A. O. Smith Corp. Engineers and contractors, Arthur G. McKee & Company.

Why Sohio put Monel on Top..

when they picked materials to limit corrosion in new atmospheric towers

Slugs of crude get shunted around the country today, as if they were tank cars.

With so much crude moving in "common-carrier" pipelines...there's no telling from one day to the next what composition you may be called upon to refine.

SOHIO's Cleveland Number 1 Refinery draws its crudes, for example, from the Mid-Valley and Buckeye Lines . . . and taps output of wells in Arkansas, Illinois, Mississippi, Oklahoma, Texas and Louisiana. Most of the time sulfur content is under 1½%. Sometimes it goes much higher. Salt content, too, is unpredictable.

That's why SOHIO engineers went all out to limit corrosion in two new 130-ft. atmospheric towers for crude distillation. They lined the bottom 50 feet with Type 405 (12% Cr) to resist hot sulfide corrosion. In the middle sections, where naphthenic acids are likely, they put nickel-bearing Type 316 ELC stainless*.

For the top 40 feet, they chose Monel®. In this location they have found Monel to be the most economical material for the job.

There are several reasons for this. For one thing, Monel costs less per pound than other alloys able to withstand the corrosion. Furthermore, it requires no heat-treatment after fabrication to restore corrosion resistance, since its corrosion resistance is not impaired by welding. Then, too, Monel is easy to form . . . and lends itself well to Smithlining.

(Smithlining is the resistance welding process used by the tower fabricators, A.O.Smith Corp., to bond Monel and other liners to carbon steel walls.)

But the most important reason for choosing Monel is the way Monel stands up to the various corrosives found in upper sections of fractionators.

In this area, reflux pushes vapor temperatures down to about 250°F. Walls and trays cool vapors further. As they go below the dew point, aqueous hydrochloric and sulfuric acids form in the condensate. Corrosive salt compounds may be present also.

The record of Monel in resisting *all* these forms of corrosion, when temperatures are under 500°F., is outstanding . . . so outstanding that many companies consider Monel to be the standard construction material for lining top portions of fractionators.

If your next inspection shows corrosion at the tops of your crude distillation towers, why not investigate the use of Monel? A letter addressed to Inco's Corrosion Engineering Section will bring full information regarding the application of Monel in this corrosive service. No cost or obligation, of course.

*Where there is a possibility of naphthenic acid attack, either alone or combined with high temperature sulfur corrosion, *Inconel*® is often a favored material. Since its thermal expansion coefficient (6.4 for the wrought material) is very close to that of mild steel, Inconel lends itself unusually well to lined construction.

INCO

Monel...*for minimum maintenance*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

for greater efficiency . . .

INTALOX

SADDLE PACKING

INTALOX — the uniquely different "saddle" tower packing — gives higher flow capacities, lower costs, and greater efficiency in virtually any type of diffusional operation.

INTALOX packs with greater randomness than any tower packing available. Its non-symmetrical design is such that no two pieces can fit exactly one into the other. Thus there is no "nesting", minimum possibility of blocked flow, complete freedom from pronounced channeling.

The elimination of pattern packing not only means more free space, but a greater surface area accessible to liquor and gas.

Early tests which indicated Intalox had a 30%-35% lower pressure drop and 15%-20% higher flooding limit than Berl saddles are being repeatedly substantiated by users' reports. In comparative studies with Raschig Rings, Intalox is showing a pressure drop 60%-65% lower; flooding limits 30%-40% higher.

Intalox is establishing definite savings on operational costs; reducing blower and pumping equipment requirements; reflecting increasing indications that substantial savings in construction costs through reduction in tower sizes are definitely practical.

Intalox is currently available in ½", ¾", 1" and 1½" sizes in either white chemical porcelain or chemical stoneware.

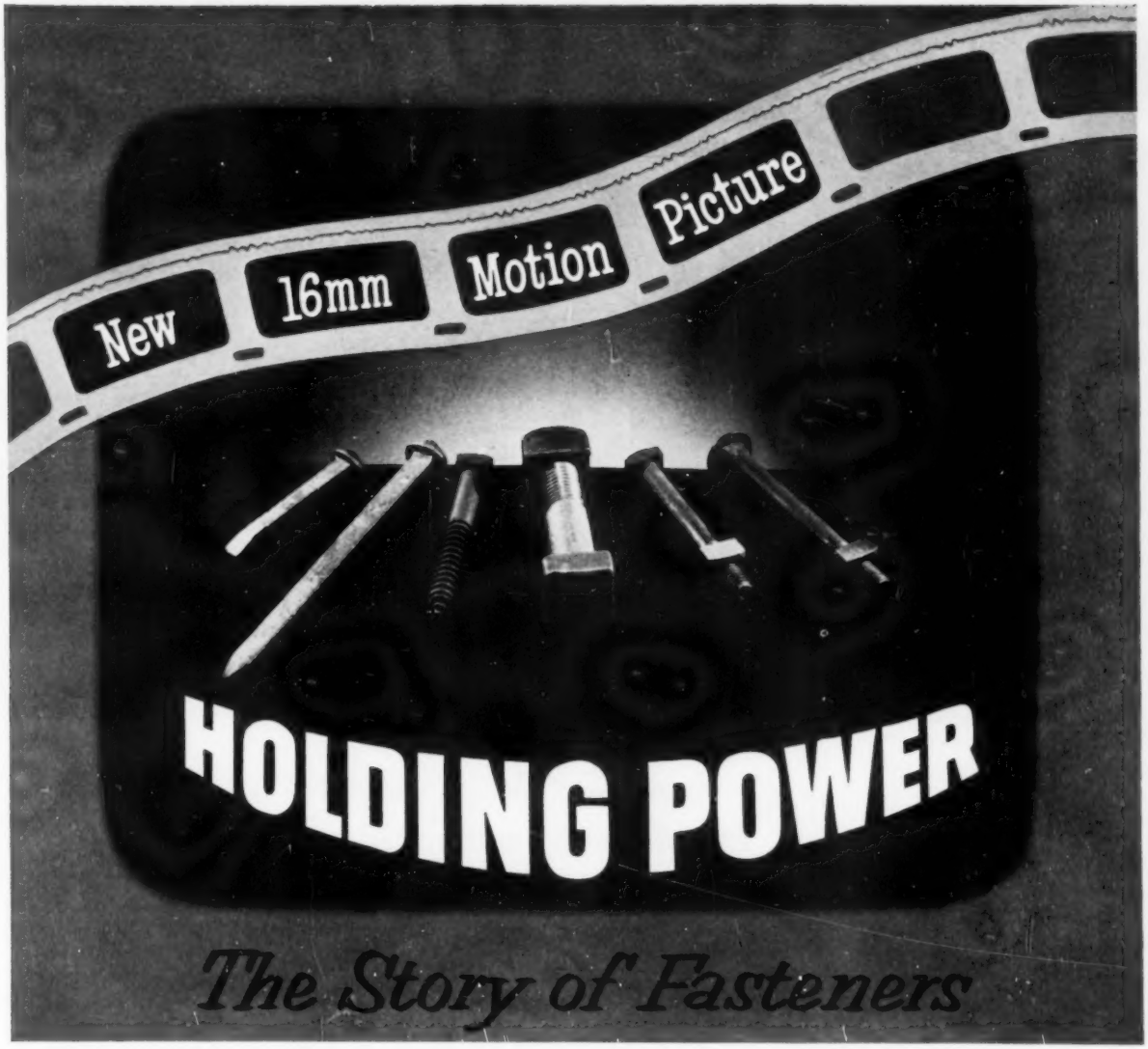
A request to Process Equipment Division, The U. S. Stoneware Co., Akron 9, Ohio, will bring samples and technical data quickly.

300C-1

U. S. STONEWARE

AKRON 9, OHIO

MANUFACTURERS AND FABRICATORS
OF CORROSION RESISTANT MATERIALS
SINCE 1865



This important new film dramatizes the story of fasteners. It delves into such common, everyday items as machine bolts, nuts, rivets, track bolts and spikes, and also describes roof bolts, high-strength bolts, oil-well sucker rods, and a wide range of special fasteners. The film takes you behind the scenes in our modern fastener plants. It shows how fasteners are made, and explains the vital part they are playing in industry.

"Holding Power" is in color, with sound. It is on 16mm film, and has a running time of approximately 30 minutes.

"Holding Power" is an ideal film for showing to distributors, consumers, and others closely associated with fasteners. It is also an interesting, highly educational picture for general audiences. There is no charge, except for the return postage. If you would like a print for showing, fill out the coupon, selecting a date well in advance, and mail it to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

BETHLEHEM STEEL

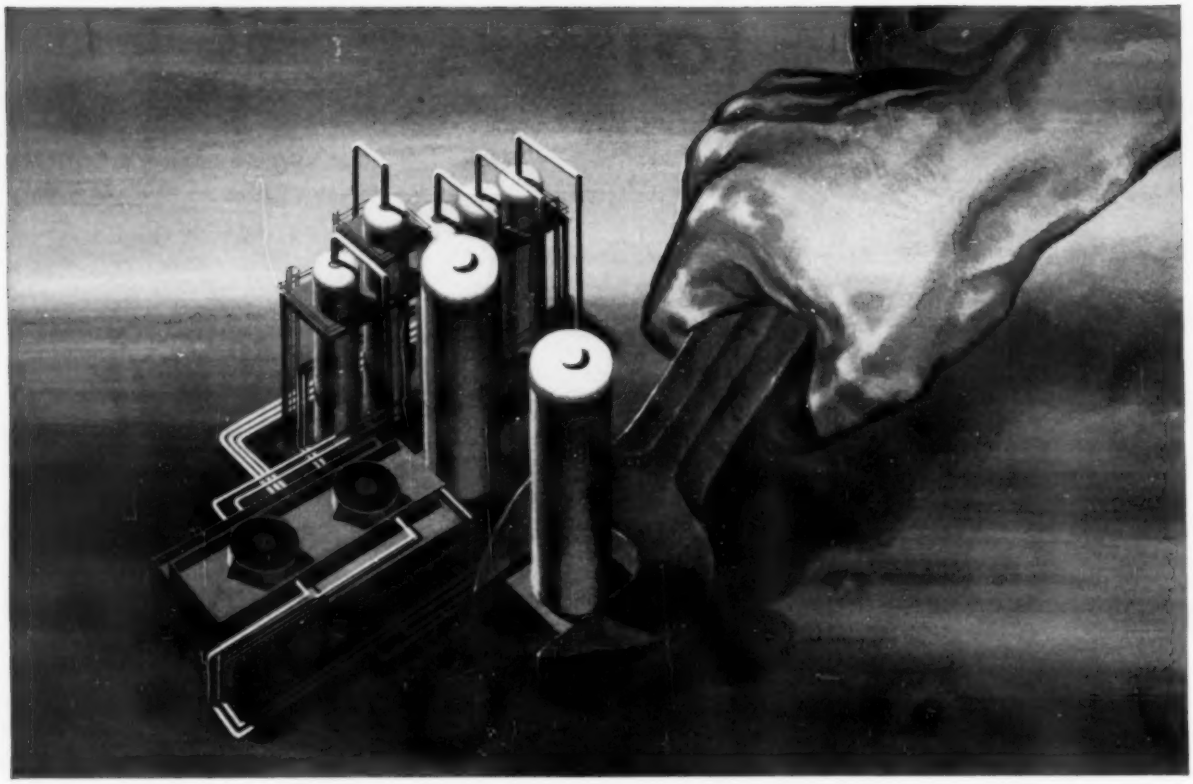
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Gentlemen:
Please send me a print of your new film, "Holding Power." I will return it promptly, paying return postage.

Approximate date wanted _____
Send Print to This Address _____
_____
Name of Company or Organization _____
_____
MY-15 Signature _____

(To obtain more data on advertised products see page 128)



How To Bolt Down Profits In New Production Planning

Has a tough operating problem threatened your output schedules? Here's how one producer licked his problem before it started.

For a new process this refinery required economical heating, under vacuum, of highly corrosive crude that was to be pumped into a fractionator for further processing.

SOLUTION: Crude oil feed tanks of stainless-clad steel, vertical type, externally braced. Heat is provided by an internal steam coil of solid stainless steel. Vacuum operation is withstood successfully by clad steel tank design. Flued openings and manholes provide for easy inspection and maintenance. Inner stainless surfaces resist corrosion; carbon steel backing and steel stiffening rings insure rigidity and strength with maximum economy. Result: economical heating of crude oil to proper temperature. Corrosion problem eliminated by equipment with low first cost and long service life. Maintenance costs reduced to a minimum.

This unit increased this company's output and profits. It was ideal for the job. How was this advance achieved? Through close coordination between engineering staffs of progressive Equipment Builders, process engineers, designers and materials suppliers.

Such bonus attention is a practice with progressive Equipment Builders. They turn to Lukens regularly for its knowledge of materials as well as its wide range of low-cost clad steels.

Would you like such specialists to study your problem? We will send you their names. Write today explaining your need. Manager, Marketing Service, 682 Lukens Building, Coatesville, Pa.

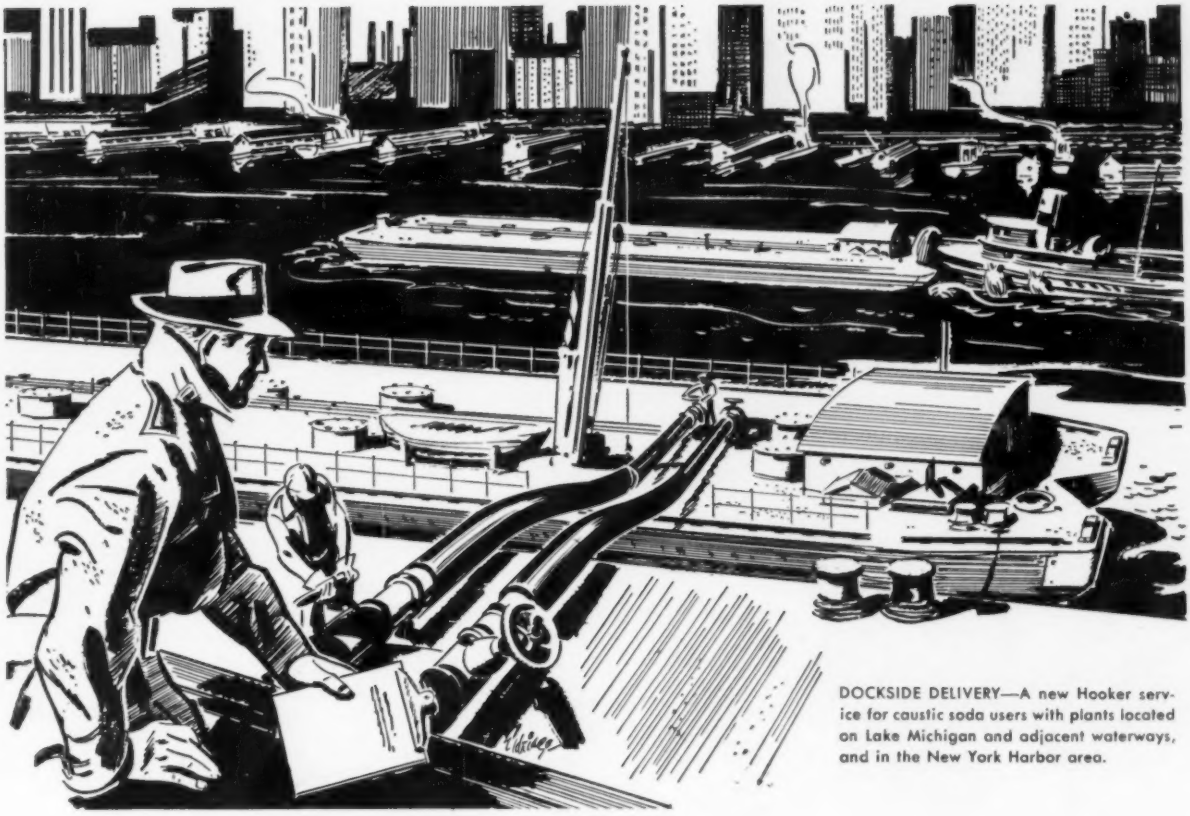
LUKENS

World's Leading Producer of

SPECIALTY STEEL PLATE · PLATE SHAPES · HEADS · CLAD STEELS

LUKENS STEEL COMPANY, COATESVILLE, PA.

(To obtain more data on advertised products see page 128)



DOCKSIDE DELIVERY—A new Hooker service for caustic soda users with plants located on Lake Michigan and adjacent waterways, and in the New York Harbor area.

For safe, sure, consistent results . . .
STANDARDIZE on Hooker Caustic Soda

Why this is important to you:
With *uniform* caustic soda coming in, shipment after shipment, you can standardize your caustic handling and processing.

You need not adjust your process to meet variations in incoming caustic shipments. You can be sure each new shipment matches your current inventory.

You get this kind of uniformity with Hooker Caustic Soda. Every step in the manufacture—from salt brine to tank car—is controlled at Hooker, by Hooker. More than 20 separate inspections and analyses safeguard the uniformity of the Hooker Caustic you buy.

This is one reason why leaders in 30 industries specify *Hooker* Caustic—and why many have specified it for nearly 50 years.

Hooker uniformity can pay off for you, too—in lower operating costs and smoother, better processing. Try it and see. A letter or phone call to the nearest Hooker office will bring you product data and contract information.

Buy the UNIFORMITY Hooker Caustic Soda gives you

Forms: Liquid 50% and 73% • Flake • Solid • Special fine flakes

Containers: Tank cars • Tank wagons • Barges • Drums

For fast service, phone:

CHICAGO	CEntral 6-1311
LOS ANGELES	NEvada 6-3826
NEW YORK	MUrray Hill 2-2500
NIAGARA FALLS	6655
TACOMA	BRoadway 1215

HOOKER CHEMICALS

—*From the Salt of the Earth*—

HOOKER ELECTROCHEMICAL COMPANY

HOOKER ELECTROCHEMICAL COMPANY
4713 Buffalo Ave., Niagara Falls, N. Y.

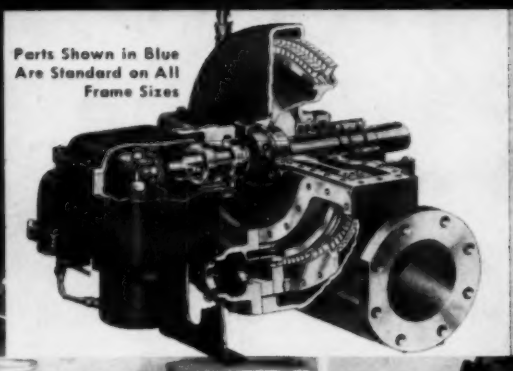
Please send ☐ data sheets on Hooker Caustic Soda; ☐ Bulletin 100 describing Hooker products and services.

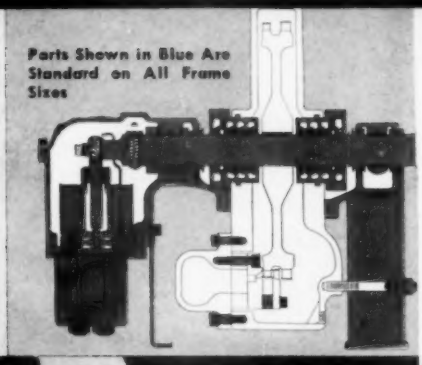
Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....





This display of interchangeable parts on G.E.'s Type DP turbine covers over 85% of the parts subject to wear—means you tie up less money in inventory.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

85% Interchangeability of Turbine Parts Means Less Money Tied Up in Inventory

Over 85% of the wearing parts are interchangeable among General Electric's Type DP Turbines—regardless of turbine rating. This means you don't have to tie up a lot of money stocking spare parts for each turbine; one set of parts protects a whole line-up. This feature alone can save you up to $100.00, even in installations of just two turbines of different sizes. Greater savings, of course, accrue as the number of turbines in the plant increases.

All of the parts, except for the governing end, are also interchangeable between G.E.'s Type DP Mechanical-drive Turbine and the Type DR which is designed for slightly wider speed range and greater horsepower.

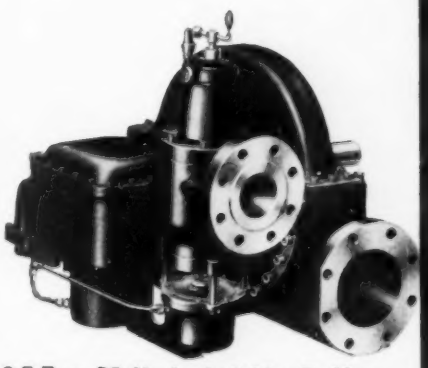
This interchangeability is just one of many DP features which save you money. The chart below indicates other areas of savings.

Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features that save you extra costs. For more information contact your nearest G-E Apparatus Sales Office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." General Electric Company, Schenectady 5, N. Y. 252-65

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

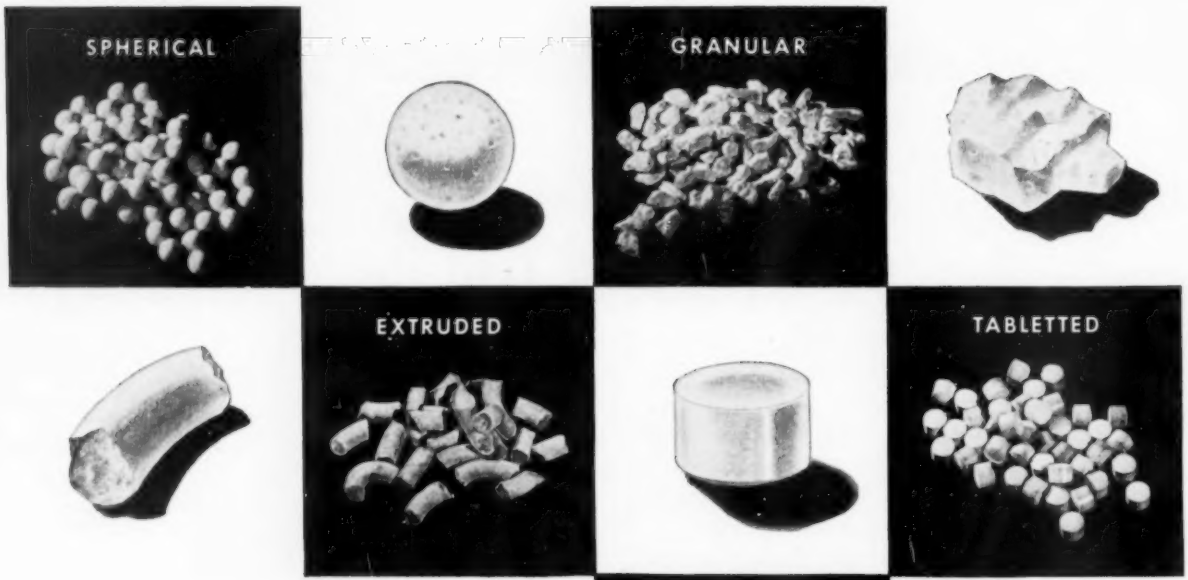
THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
SINGLE RESERVOIR FOR COOLING LUBE OIL Eliminate extra cost of piping cooling water to and between bearings.	50.00
MAJORITY OF PARTS INTERCHANGEABLE One set of spare parts protects several units—less money tied up in inventory.	100.00
METALLIC-LABYRINTH VALVE STEM BUSHING Eliminate labor costs of replacing soft packings; cut down-time production losses.	50.00
SHAFT MONEL-SPRAYED AT PACKING FIT Saves frequent cost of purchasing and installing carbon rings; contributes to long shaft and packing life.	20.00
ESTIMATED TOTAL SAVINGS	$420.00



G-E Type DP Mechanical-drive Turbine

COMPARE THE FEATURES
EVALUATE ALL THE COSTS

See why G-E Standard Type DP turbines are your most economical buy.



HARSHAW preformed CATALYSTS

specified by YOU...made by US!

Harshaw manufactures to specification dozens of catalysts for many different and complex manufacturing processes. The experience of more than fifteen years in helping to solve a great number of individual catalyst problems places us in a most helpful position, either in the development of the best and most economical catalyst, or in qualifying with large production capacity requirements. If you have a problem, perhaps a discussion with us will prove helpful.

SEND FOR *this 8-page booklet on Harshaw Catalysts*

PROCESS

Hydroforming	Cyclization	Oxidation
Dehydrogenation	Dehydration	Desulphurization
Alkylation	Isomerization	Hydrogenation

TYPICAL CATALYSTS

Aluminum Chloride Anhydrous — Boron Fluoride Addition Compounds
Boron Trifluoride — Hydrofluoric Acid Anhydrous

Alumina — Chrome Alumina — Molybdena Alumina — Tungsten Alumina
Cobalt — Copper — Magnesia — Mercury — Nickel — Vanadium

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

SALES BRANCHES: Chicago 10, Illinois, 505 North LaSalle St. • Cincinnati 13, Ohio, 6265 Wiehe Rd. • Detroit 28, Michigan, 9240 Hubbell Ave. Houston 11, Texas, 6622 Supply Row • Los Angeles 22, California, 3237 S. Garfield Ave. • New York 17, N. Y., 420 Lexington Ave. Philadelphia 48, Pennsylvania, Jackson & Swanson Sts. • Pittsburgh 22, Pennsylvania, 505 Bessemer Bldg., 6th & Duquesne Way

No Room for Industrial Complacency

Do you believe that American industry is equipped with remarkably up-to-date and efficient machinery? If you do, you are mistaken. The fact is that a large share of American industry's equipment is ancient, of obsolete design and incapable of attaining the efficiency that is made possible by modern production techniques.

This fact is documented by the Seventh Inventory of Metalworking Equipment, just completed by AMERICAN MACHINIST, a McGraw-Hill publication. In brief, AMERICAN MACHINIST shows that:

1. More than half (56%) of American industry's most basic production equipment—machine tools and metal-forming units—is overage, and much of it is so old that it has very limited usefulness.

2. Since Korea, the situation has become dangerously worse.

Facts vs. Plausible Theory

These conclusions contradict the widely-held impression that America's industrial equipment is in better physical shape than ever before. The prevalence of this impression is not surprising. We, as a nation, have spent about $125 billion for new industrial plant and equipment since World War II. That is more than in any previous period in our history. During 1953, American industry invested $21 billion in new plant and equipment, an all-time high. From this, it would be reasonable to infer that our industrial plant and equipment must be in fine condition.

But the facts do not support that inference with respect to the machine tools and other metalworking equipment that are so crucial to our economy in war and peace. Here are the key findings of the AMERICAN MACHINIST Inventory:

(1) More than one million machine tools—out of a total of less than two million in the metalworking industries—are at least ten years old. Many of these, after day and night operation

 (To obtain more data on advertised products see page 128)

during the war years and the recent rush to rearm, are actually much older production-wise than their age in years indicates. In most cases, these machines are unable to produce goods as efficiently as modern equipment can, thus needlessly increasing costs.

(2) Almost one out of five machine tools is more than twenty years old. Most of these machines are so outdated by modern standards that they have little more than scrap value. And an even larger portion of our metal-forming equipment (presses, brakes and shears, bending and straightening machines) has passed the 20-year mark and is beyond normal retirement age.

(3) Two out of three machine tools are of designs predating World War II, though many of them have been built since the war. Thus, two-thirds of our machine tools fail to incorporate the many major postwar improvements in design and operating methods.

(4) Never before has outmoded high-cost equipment been so widely diffused throughout American industry. In every one of fifteen major divisions of metalworking production, more than 45% of the machine tools are at least ten years old.

(5) Not since the depression days of the 1930's has the average age of machine tools risen so rapidly as it has in the past four years. Today, 55% are ten years old or older, compared with 43% just before Korea.

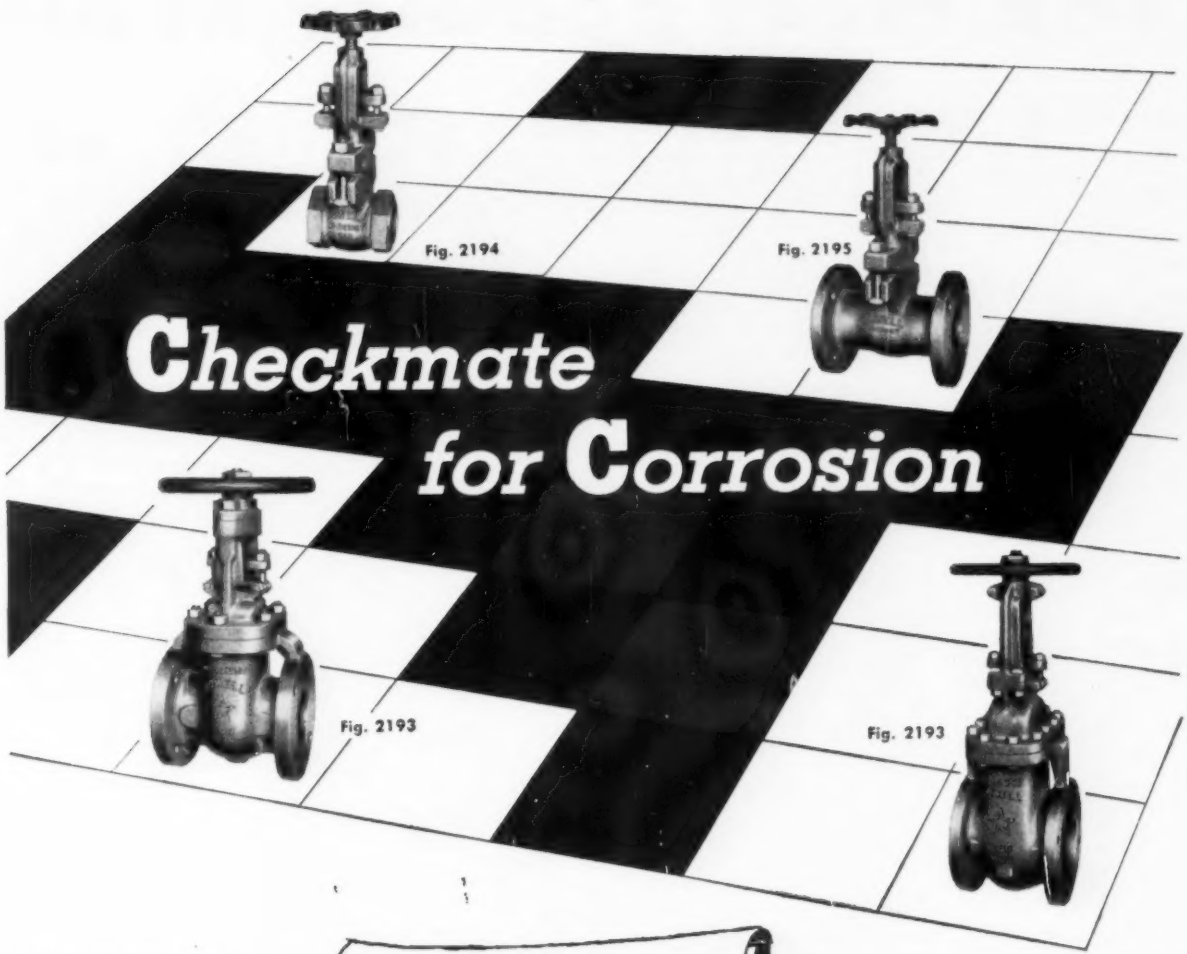
Quality vs. Quantity

Why has the condition of our metalworking equipment been steadily deteriorating since the end of World War II? Part of the explanation lies in the fact that, in the immediate postwar years, production of metalworking equipment lagged behind the production of industrial equipment generally. The larger part of the explanation, however, lies in the tremendous postwar expansion of the American economy. This expansion, which has more than doubled our total industrial capacity, has imposed requirements for metalworking machinery that have been met only by more extensive use of old and obsolete tools. In the critically important field of metalworking, the job of providing up-to-date tools is bigger than it ever has been.

There are those who argue that the time has come to cut back investment in new industrial plant and equipment and divert more of the national income into current consumption. They cite both the great increase in the nation's total industrial capacity since World War II and the fact that some industries now have more than ample producing capacity to meet their needs. But this type of calculation leaves out the *efficiency* of that producing capacity.

The AMERICAN MACHINIST Inventory makes it manifest that in the key field of metalworking we are alarmingly short of first-rate, low-cost producing capacity. If we fail to remedy this situation by speeding the replacement of obsolete tools, it will be at the peril of our prosperity, at the peril of a sustained increase in our standard of living and of our national security.

McGraw-Hill Publishing Company, Inc.



GATE VALVE *(upper left)* **Fig. 2194** for 225 pounds W.O.G. Screwed ends, bolted flanged bonnet, inside screw rising stem. Body and bonnet are made of Ni-Resist, with 18-8S Mo Stainless Steel (Type 316) stem, seats, and wedge. Sizes ¼" to 2", inclusive.

GATE VALVE *(upper right)* **Fig. 2195** for 200 pounds W.O.G. Flanged ends, bolted flanged bonnet, inside screw rising stem. Ni-Resist body and bonnet, with stem, seats, and wedge made of 18-8S Mo (Type 316) Stainless Steel. Sizes 1" to 3", inclusive.

GATE VALVE *(lower left)* **Fig. 2193** for 200 pounds W.O.G. Flanged ends, bolted flanged bonnet, outside screw rising stem and one-piece yoke. Body, bonnet, and yoke are Ni-Resist. Stem, seats, and wedge are 18-8S Mo (Type 316) Stainless Steel. Size 4".

LARGE SIZE GATE VALVE *(lower right)* **Fig. 2193,** 5" to 12", inclusive, for 200 pounds W.O.G. Flanged ends, bolted flanged bonnet, outside screw rising stem and two-piece yoke. Ni-Resist body, bonnet, and yoke, with 18-8S Mo (Type 316) Stainless Steel stem, seats and wedge faces.

It's a winning move every time you select Powell *Ni-Resist* Valves. For here is an alloy that has far greater corrosion and heat resistance than ordinary Cast Iron. Similar to gray iron, and resembling austenitic stainless steel in many ways, no other cast metal offers such a unique combination of useful properties.

Powell Ni-Resist Valves are especially adapted for handling pulp and paper mill liquors, oil refinery acids, alkalies and sludges, caustic soda, pickling solutions, sea water and many other fluids. Shown here are just a few of them to help you checkmate the high cost of corrosion. They're available through distributors in principal cities. If a distributor is not located near you, just write us—The William Powell Company, Cincinnati 22, Ohio. We'll be pleased to tell you more about these valves—or to help you with your valve problems. Powell has probably solved more valve problems than any other organization in the world.

CONTROLS FOR THE LIFE LINES OF INDUSTRY

..... 108th YEAR

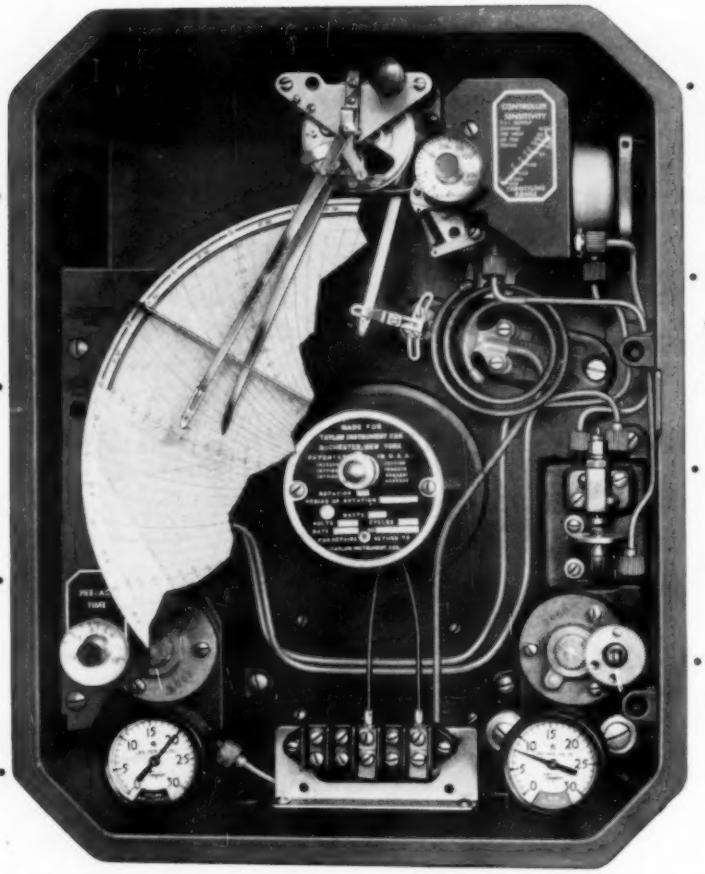
The most popular of all

DEPENDABLE

RUGGED

EASY, LOW COST MAINTENANCE

SIMPLE ADJUSTMENTS



VERSATILE

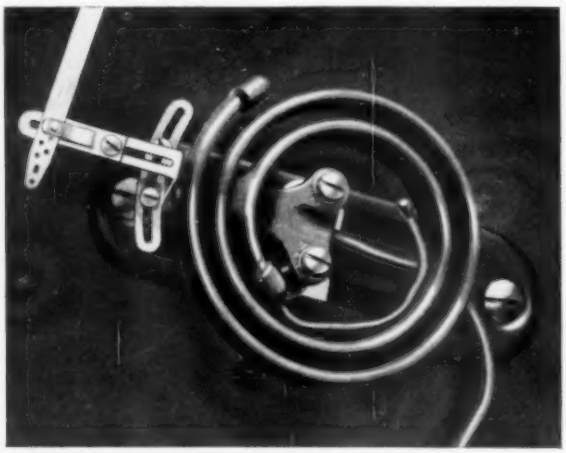
TROUBLE-FREE

SIMPLE OPERATION

LONG LIFE

Single Duty FULSCOPE Recording Controller with Adjustable Sensitivity, Automatic Reset and PRE-ACT responses. Double Duty control mechanisms, with *any* combination of control responses, afford a great advantage on many applications.

Sensitivity adjustment unit; single, continuous adjustment calibrated in specific units.



Improved sub-base permits easy, precise replacement of pre-calibrated actuating systems in field.

instruments celebrates its 15th BIRTHDAY !

THANKS to you, the Taylor FULSCOPE* Controller today enjoys unrivaled popularity. We say thanks to you because this instrument was designed to meet your exacting requirements as determined by an industry-wide survey. The result is dependable performance year after year, and low maintenance cost. In the petroleum industry, natural gasoline plants particularly, these instruments are relied upon to operate automatically for hours on end unattended. Thus the operators are freed to take care of other maintenance duties.

For the benefit of those who are new in positions of responsibility in the selection of instrumentation, here are some of the reasons why Taylor Series 100 FULSCOPE Controllers have been able to meet these exacting requirements and consequently reign supreme throughout industry.

ADAPTABILITY

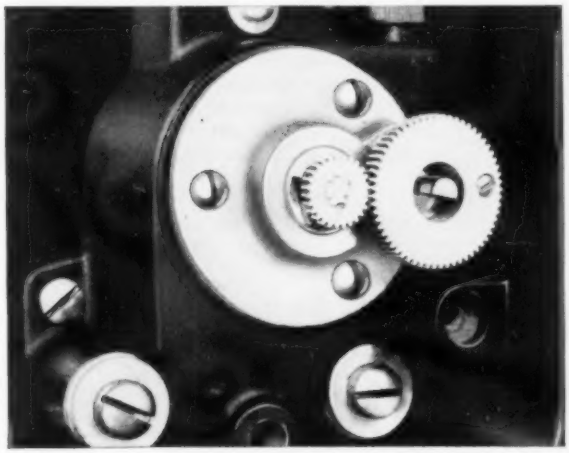
1. Extremely versatile. The same control mechanisms are available for Temperature, Pressure, Flow and Liquid Level—in either recording or indicating models, as locally mounted controllers, transmitters or controlling receivers. Interchangeable unit construction permits a small inventory of parts. Pre-calibrated units eliminate expensive checking. Easy visibility and accessibility of components means an instrument man can have a unit back on the job with minimum down time.

2. Adaptable to any control problem because the FULSCOPE Controller has three control effects:

(a) Proportional Response—available in three forms: Fixed High Sensitivity (1000 psi per inch pen movement): Adjustable Sensitivity (1000 to 1 psi); and Limited Range Sensitivity (400 to 30 psi). **(b) Automatic Reset Response,** completely and continuously adjustable (.05 to 5 repeats per minute). **(c) PRE-ACT* Response** (rate action) continuously adjustable within the range of 0.2 to 10 mins. All the adjustments are wide range and continuous. Any combination of these control responses may be used to provide any required quality of control. PRE-ACT and reset units are interchangeable.

3. Proper Adjustment Easily Obtained. Control Response Adjustment Dials are calibrated in specific units, repeatable in all instruments. Optimum settings are quickly determined.

4. Controller action simply changed by lifting a spring clip and rotating set-point knob.



Interchangeable needle valves in Automatic Reset and PRE-ACT units.

DEPENDABLE OPERATION

5. Control point always matches set point when automatic reset is used, thanks to fully pneumatic sensitivity reduction. Lowering sensitivity for stability does not reduce the effectiveness of the reset response. Result—control point always returns to set point, regardless of load changes.

6. Trouble-free air system. Metal disc type filters are built-in features, easily removed for cleaning. Both relay air valve and nozzle are made of 18-8 stainless steel. A simple system, made of corrosion resistant parts, easily accessable for cleaning.

7. Lifelong Accuracy. Fewer links and pivots. Dead spot and hysteresis practically non-existent due to lightweight stainless steel link and small diameter burnished pivots. This lightweight construction nullifies vibration effects. Spring pivot clips, which do not gum up or corrode, replace screws. Over and under-range linkage protection provided when required.

Whether your processing problems are simple or complex, there's a Taylor instrument or control system and a competent Taylor Field Engineer ready to help you solve them.

Write for Bulletin 98151. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

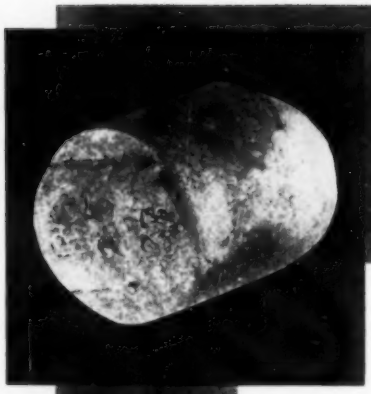
Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Reg. U. S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

(To obtain more data on advertised products see page 128)

this little plug is
positive proof . . .



that Chicago Bridge & Iron Company Tanks are built to your specifications

A trepanning tool is used to cut the required number of plugs from the welded joints on every welded structure built by Chicago Bridge & Iron Company. Boiling the plugs in muriatic acid etches them so that the welds stand out clearly and any defects may be quickly discovered and corrected. This is but one of the many important things covered by our Field Welding Supervisory Service to assure you that Chicago Bridge & Iron Company welded steel structures are built in accordance with the governing specifications.

Representatives of the Chicago Bridge & Iron Company Field Welding Supervisory Service are specially trained. They assist the Foreman in charge of a job check welding equipment and help him magnaflux or x-ray welds if required by the specifications. If additional welders are needed on large jobs, they help train and qualify men to assure the necessary skill and production capacity.

Field Welding Supervisory Service helps make possible the high standards that Chicago Bridge & Iron Company is able to achieve . . . at *no extra cost* to you! When planning the installation of welded steel plate structures, write our nearest office for information, estimates or quotations . . . Insist on the Field Welding Supervisory Service that *assures* you of the best structure your money can buy!

CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, and GREENVILLE, PENNSYLVANIA

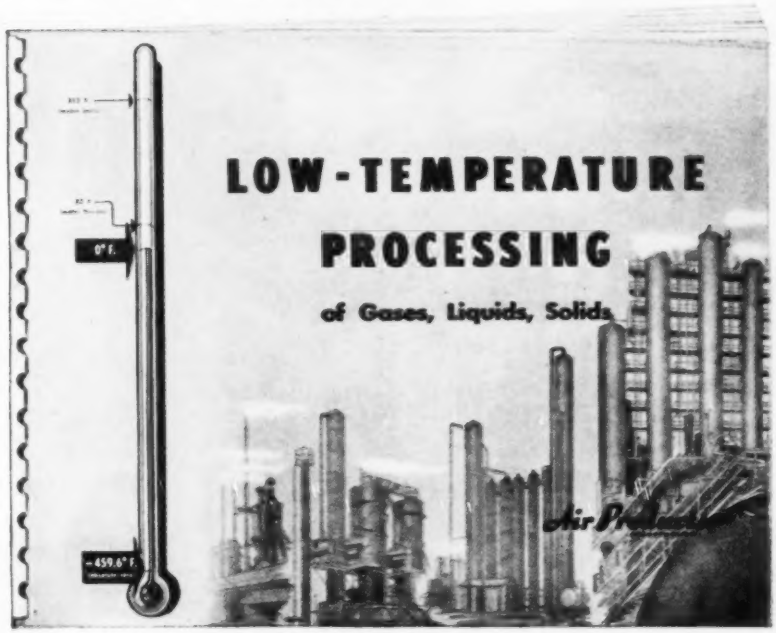
Atlanta 3 ..... 2103 Healey Building
Birmingham 1 ..... 1327 North Fiftieth Street
Boston 10 ..... 1029-201 Devonshire Street
Chicago 4 ..... 2114 McCormick Building
Cleveland 15 ..... 2215 Midland Building
Detroit 26 ..... 1532 Lafayette Building
Houston 2 ..... 2130 C & I Life Building
Los Angeles 17 ..... 1328 General Petroleum Building
New York 6 ..... 3310-165 Broadway Building
Philadelphia 3 ..... 1630-1700 Walnut St. Building
Pittsburgh 19 ..... 3238 Alcoa Building
Salt Lake City 4 ..... 530 West 17th South Street
San Francisco 4 ..... 1559-200 Bush Street
Seattle 1 ..... 1330 Henry Building
Tulsa 3 ..... 1620 Hunt Building

REPRESENTATIVES AND LICENSEES

Horton Steel Works Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Campagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Comprimo, N.V., 21, Amstel, Amsterdam (C) Netherlands
Sociedade Chibridge de Construcoes Avenida General Justo, 275, Grupo 306, Rio de Janeiro, Brazil

Take Dollars Out Of Waste Gas, Natural Gas, Air

This New 36-page Brochure Tells How



GAIN NEW PROFITS thru low-temperature separation of fluid mixtures . . .

UTILIZE petroleum fluids, coke oven gas, natural gas, air . . .

PRODUCE hydrogen, nitrogen, oxygen, ethylene, ammonia synthesis gas, many others.

SEE the broad opportunities open to industry . . . read how you can find out *your* possibilities.

Extremely low temperatures—down to −450°F.—are today finding use in many industries . . . chemical, petroleum, petrochemical, steel, electronics, industrial gas. They are being used to recover valuable chemicals from previously wasted or neglected mixtures . . . to widen profit margins over other recovery methods . . . to store gases at less cost.

This new brochure explains the broad opportunities . . . illustrates present and probable applications. It tells how you can find out the possibilities open to your company . . . get answers on separations . . . capital and operating costs . . . pay-out periods.

A special section on air plants features *Air Products* Generators that make oxygen-nitrogen-argon *simultaneously.* Another shows *Air Products* Low-Temperature Apparatus—available in many standard and special types and sizes.

Air Products
INCORPORATED

Specialists in Low-Temperature Processing

Estimates • Process Design • Apparatus Design • Apparatus Manufacture

Air Products, Incorporated, Dept. L, Box 538, Allentown, Pa.
Please send me a copy of your new brochure, without obligation.

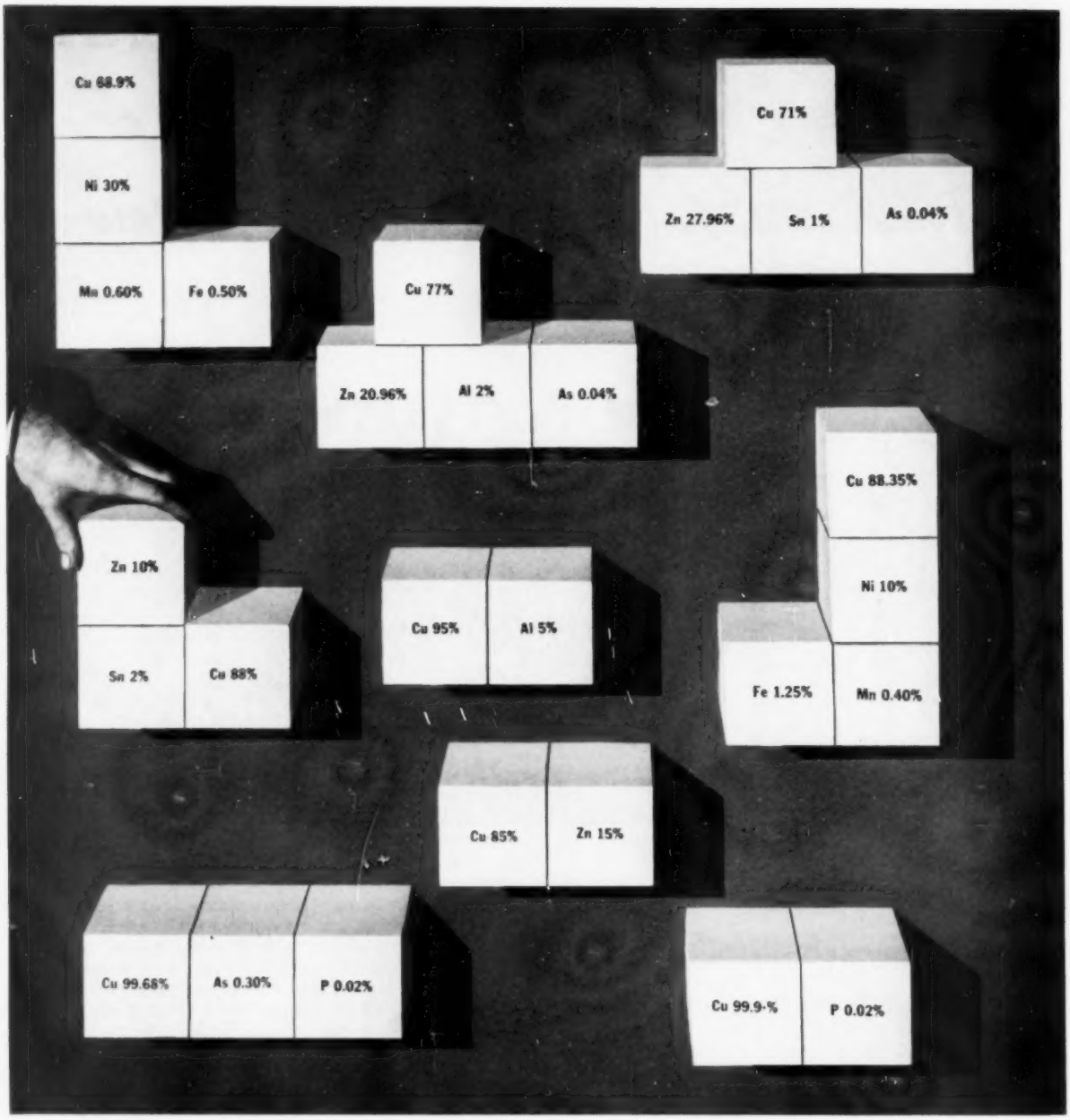
Name.....Title.....

Company.....

Street.....

City.....Zone.....State.....

(To obtain more data on advertised products see page 128)



Which combination is best for your tube problem?

On the decision you make depends the rate of return on your investment. And it's apt to be a big investment.

Each of these condenser and heat exchanger tube alloys has been scientifically developed to have specific metallurgical properties to meet specific operating conditions.

To supplement extensive metallurgical research and programs of laboratory and field tests, our Technical Department maintains files that record over many years the life histories of tubes in a wide range of copper alloys under many kinds of actual service. Combined with the information of metallurgical science, these records of actual performance provide the soundest possible basis for selecting the tube alloy that will best meet the conditions under which your equipment must operate.

This experience is freely available to you. Draw upon it in connection with your heat exchanger and condenser tube problems. Simply write to our Technical Department. Meanwhile, send for your free copy of Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers." *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 53119

ANACONDA®
Heat Exchanger Tubes

Ambraloy-927*; Arsenical Admiralty-439; Cupro Nickel, 30%-702; and other copper alloys
*U.S. Patent No. 2,003,685 (ORIG.)

Double Assurance

WHEN YOU SPECIFY

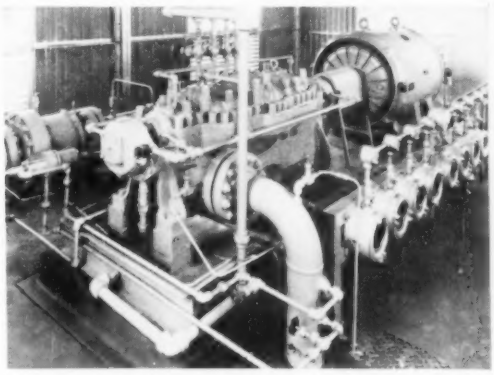
Pacific PRECISION BUILT PUMPS

The requirements for your specific service having been made known by your engineering specifications you will look carefully into the benefits offered by the various bidders. After looking, it's dollars to doughnuts your requisition will specify *"Pumps by Pacific"* because of the greater benefits of Pacific's *double assurance.*

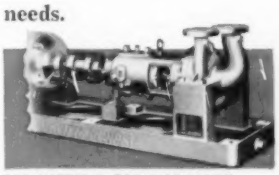
Assurance that Pacific's design, workmanship and materials will fit the requirements of your specific service.

Assurance that Pacific's dependable fast service will fit your needs.

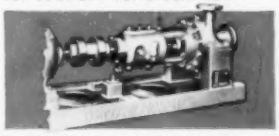
Designs to fit your specific service:



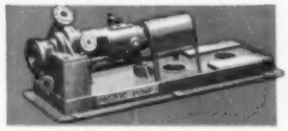
Pacific Pump Operated by Microwave—Unattended



TOP SUCTION—TOP DISCHARGE

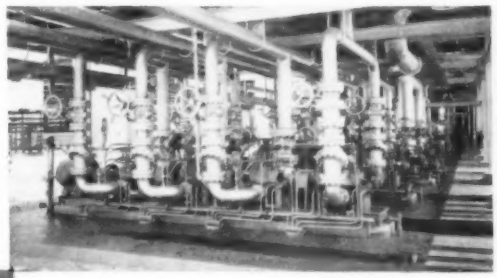


END SUCTION—TOP DISCHARGE



END SUCTION—SPECIAL DISCHARGE

Materials to fit your specific service:



Pacific Pumps for Special Service

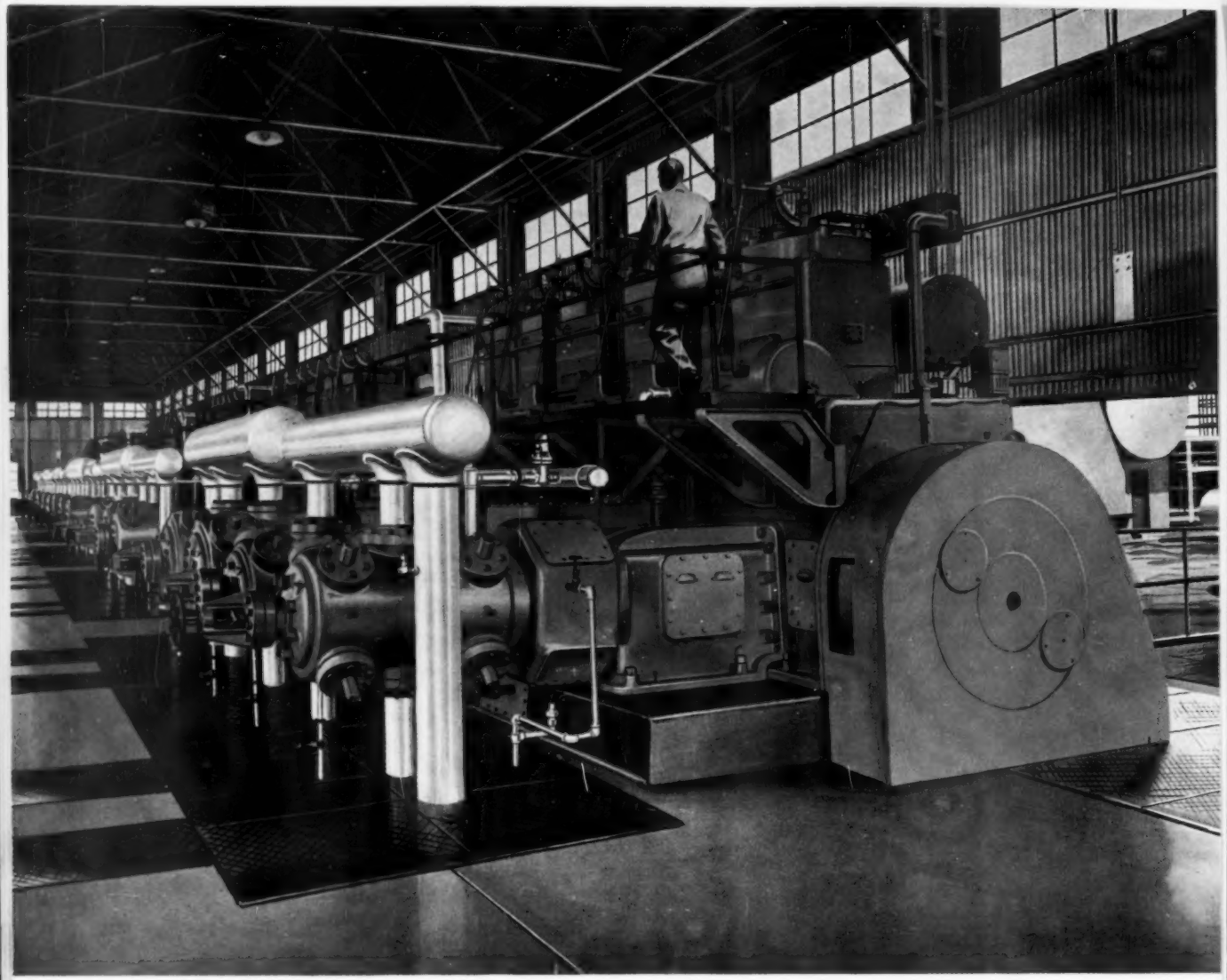
CAST IRON
ALLOY IRON
BRONZE
CARBON STEEL
ALLOY STEELS including
HIGH NICKEL-CHROME
MOLOY STEELS

PACIFIC *Precision Built* **PUMPS**

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities

CP-9



CLARK®

IS ONE OF THE DRESSER INDUSTRIES

When the need is for heavy-duty compressors, it is natural for industry to think of the leader in the field. Operating the largest and most modern plant in the world for compressors and compressor prime movers, Clark Bros. is uniquely qualified to supply big units. Backed by forty years of experience, the Clark line today consists of every major type of compressor including gas, steam and diesel-engine-driven units, motor driven units and centrifugal and axial flow types.

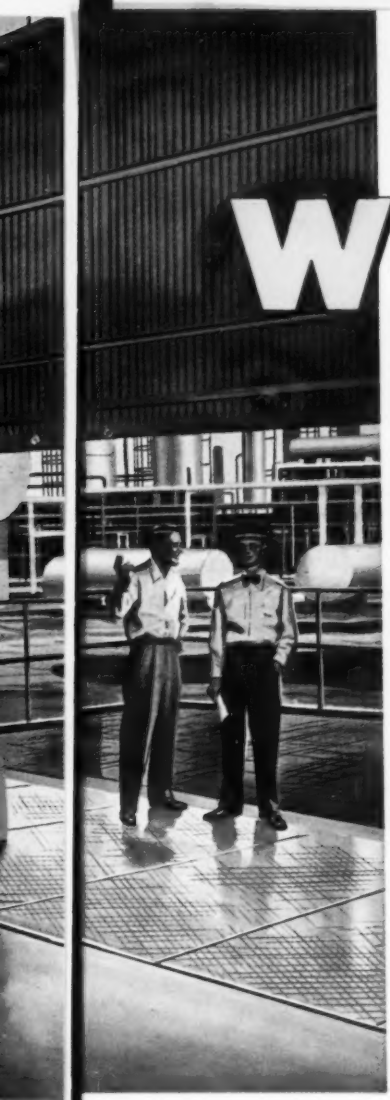
MAGNET COVE BARIUM CORP., Houston, Tex., Malvern, Ark. Magcobar drilling mud, Magcogel bentonite, Mylojel, Fiber Seal, Jel-Oil mud.

CLARK BROS. CO. DIVISION, Olean, New York. Engines and compressors—gas, steam and diesel driven.

DRESSER MANUFACTURING DIVISION, Bradford, Pa. Oil and gas pipe couplings, fittings and sleeves—rolled and welded rings—welded fittings and flanges.

KOBE, INC., DIVISION, Huntington Park, Calif. Complete hydraulic oil field pumping systems, including the Kobe Free Pump.

No. 4 in a series about Dresser Industries



What is the DRESSER plus+?

The Dresser Plus is the extra *service* you get when you deal with any Dresser company. It is an added advantage for you which stems from Dresser's unique overall organization. For Dresser is many companies with a single purpose—to provide the growing oil and gas industries with operating equipment that is *second to none*.

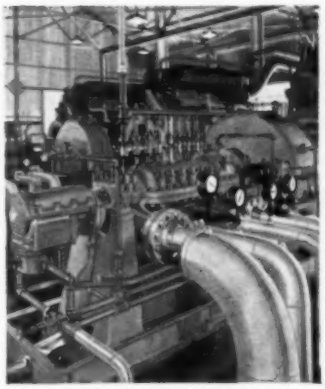
Each company in the Dresser group functions independently within its own specialized field—yet each can draw from the total resources, in manpower, research, and know-how, of the combined Dresser operations. When you work with any of the Dresser companies, all of the facilities of Dresser are *at your service*.

Planned, coordinated specialization—company by company—"one for all and all for one"—that is the DRESSER PLUS +

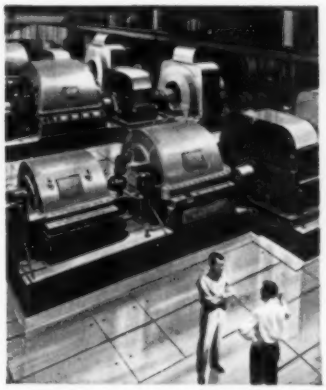
A large compressor installation represents a substantial capital expenditure. It calls for an unqualified management decision to choose the type of compressor best suited to the job. Building all types of compressors, Clark engineers can make truly unbiased recommendations for each job. Simple, rugged, highly dependable, Clark Compressors operate day and night around the world. For your next compressor application, specify Clark Compressors—and get "Precision by the Ton."

DRESSER INDUSTRIES, INC.
OIL, GAS AND CHEMICAL EQUIPMENT

ATLANTIC BUILDING ★ DALLAS, TEXAS

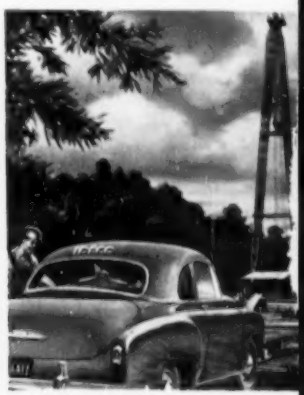


PACIFIC PUMPS, INC., Huntington Park, Calif. Centrifugal pumps, deep oilwell plunger pumps, hot oil and boiler feed pumps.



ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind. Rotary positive blowers, gas pumps, centrifugal blowers, exhausters; positive displacement meters.

SECURITY ENGINEERING DIVISION, Whittier, Calif., Dallas, Tex. Rock bits, reamers, casing scrapers, reamer rock bits, coring bits, Securaloy.



IDECO DIVISION, Dallas, Beaumont, Tex. Derricks, drawworks, rambler drilling rigs, traveling blocks, rotary tables.

YOU GET MORE!

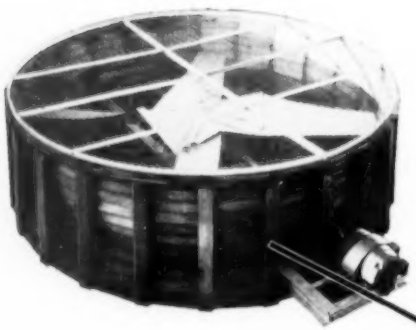
There are many reasons why you get more from Pritchard Heavy-Duty Cooling Towers. One of these is the exclusive patented features incorporated into Pritchard advanced cooling tower design.

Features like the POWAIRSAVER* fan—the first fan exclusively designed, built, rated and tested on an induced draft cooling tower for cooling tower service. These lightweight fans are designed for longer life with corrosion-resistant stressed skin blade surfaces, made of monel metal or stainless steel depending upon your specific service requirements. These patented fans are designed to operate with high aero-dynamic efficiency at low horsepower—your key to top cooling tower performance.

Over the years, leaders in the petro-chemical industry have learned *all* the reasons why Pritchard cooling towers give them more. If *you* want more efficiency . . . more years of dependable performance . . . from your next cooling tower, be sure to consult Pritchard—a founder member of the Cooling Tower Institute.

*Registered Trade Name

Industry's Partner for Progress



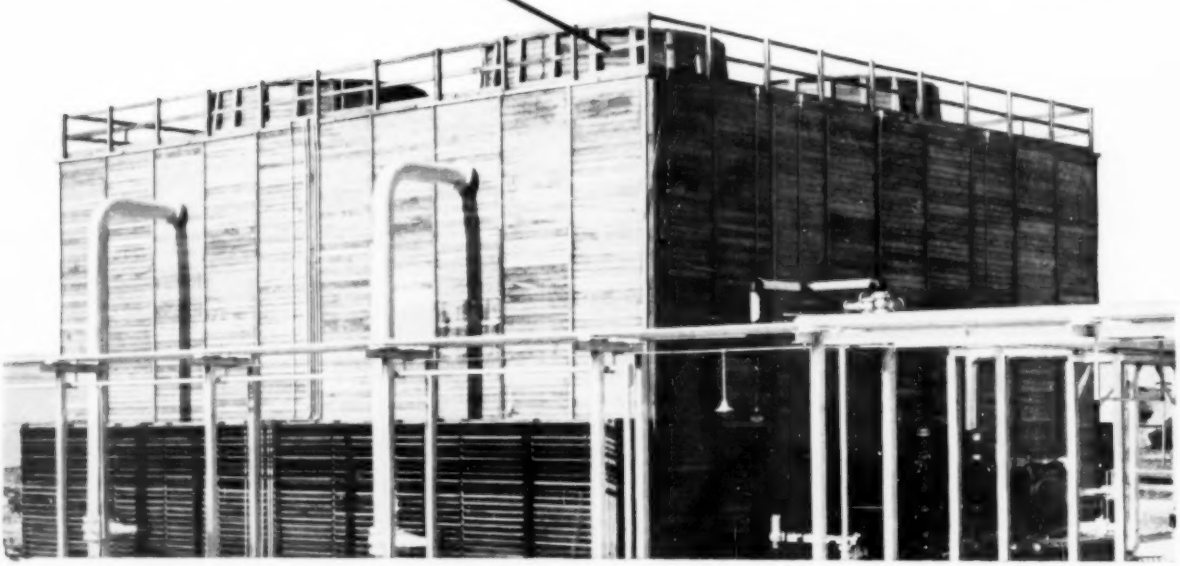
J.F. Pritchard & Co.

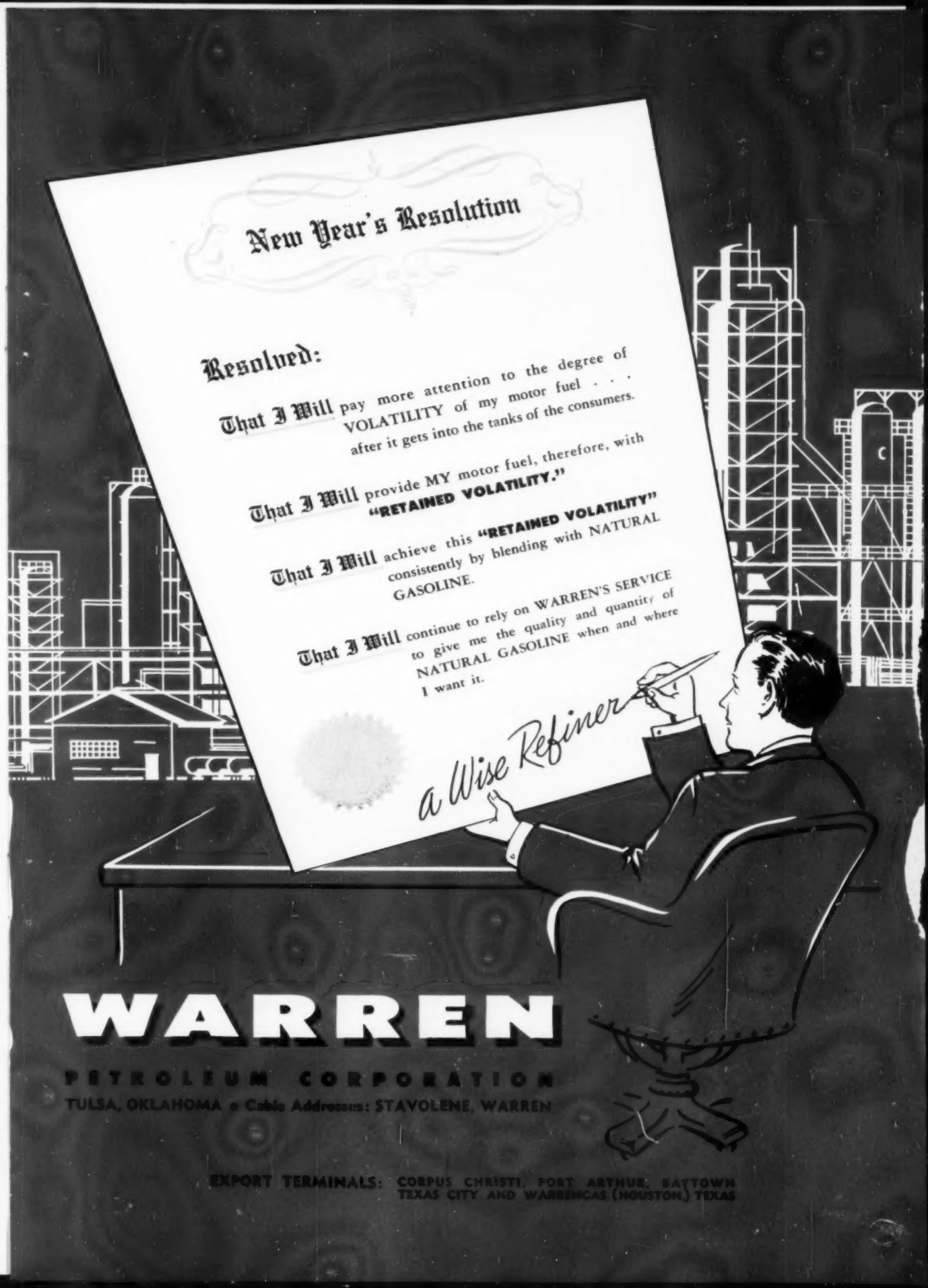
ENGINEERS • CONSTRUCTORS • MANUFACTURERS
Dept. 327, 210 West 10th Street, Kansas City 5, Mo.

Chicago • Houston • New Orleans
New York • Pittsburgh • St. Louis • Tulsa

Representatives in Principal Cities from Coast to Coast

COOLING TOWERS • SPECIALIZED HEAT EXCHANGERS • GAS & AIR TREATING EQUIPMENT • CONSTRUCTION & PROCESSING FACILITIES




New Year's Resolution
Resolved:
That I Will pay more attention to the degree of VOLATILITY of my motor fuel . . . after it gets into the tanks of the consumers.
That I Will provide MY motor fuel, therefore, with "RETAINED VOLATILITY."
That I Will achieve this "RETAINED VOLATILITY" consistently by blending with NATURAL GASOLINE.
That I Will continue to rely on WARREN'S SERVICE to give me the quality and quantity of NATURAL GASOLINE when and where I want it.
a Wise Refiner
WARREN
PETROLEUM CORPORATION
TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN
EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BATTOWN TEXAS CITY AND WARRENCAS (HOUSTON) TEXAS

your stake in our future . . .

Even though no individual refiner, nor the refining industry collectively, has any financial interest in our company the continued success of Universal is of prime importance to those in the business of economically making better products from petroleum.

It is entirely possible that many persons in close contact with the petroleum refining industry, have never realized the full significance of the contributions made by

this company. Having been available to all refiners, these developments have helped many companies, not only to meet competition, but to achieve financial success.

For almost forty years Universal's constant search for new and improved methods of refining petroleum has provided substantial dividends for those refiners, whose confidence and close cooperation have enabled us to bring notable advancements to the field of petroleum refining.

Much of the credit for our success should rightfully go to the refiners whom we have served for many years. Likewise, a great deal of the progress they have made is the result of our continuing effort to serve them in the most effective manner.

When we say . . . . Your Stake In Our Future is a big one, we honestly feel that we could not make a more truthful statement.

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILL., U.S.A.

Laboratories: RIVERSIDE, ILLINOIS

Universal Service Protects Your Investment

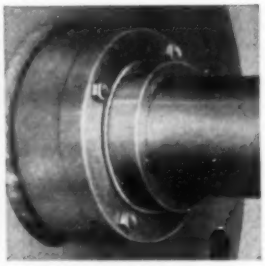
(To obtain more data on advertised products see page 128)

Easier to repack than ever before

LIGHTNIN SERIES SE (gear drive). Sizes 1 to 25 HP. Also available in V-belt drive.

No wrenches needed to shut off stuffing box from tank contents

TO SHUT OFF WITH TANK FULL, operator loosens a set screw and turns handles on bronze housing. It's as easy as closing a valve.



INSIDE THE TANK, a Teflon gasket is compressed between the seal collar and end cap. This positively seals off tank contents.

TOP ENTERING turbine and paddle type mixers for open or closed tanks. Sizes 1 to 500 HP.

LIGHTNIN PORTABLE MIXERS ... Used everywhere for hundreds of fluid mixing jobs. Thirty models to choose from. Sizes ⅛ to 3 HP.

These two new LIGHTNIN Side Entering Mixers cut maintenance time in half, they're so easy to service.

When stuffing box needs to be repacked, your maintenance man just loosens one set screw. Then he easily shuts off the stuffing box from tank contents, by rotating the outboard bearing holder, which has two easy-to-get-at handles.

Returning the mixer to operating position is just as easy and foolproof. You've never seen anything so simple and slick in a side entering mixer.

This is just one of the features that will sell you on these new LIGHTNIN Mixers. Others are:

Your choice of stuffing boxes or mechanical seals to fit the mixing job.

Smoother operation because new vertical motor mounting (on gear drive units) moves center of gravity closer to tank, minimizing vibration.

Full guarantee says the mixer will do the job and do it *right,* or your money back.

Specify the new LIGHTNIN Mixers for gasoline blending, lube oil blending, sediment control—and wherever there's a *big* mixing job that must be done right. Call your MIXCO representative today, or write us for details.

"Lightnin® Mixers"

GET THESE HELPFUL LIGHTNIN CATALOGS

This library of mixing information is yours for the asking. Catalogs contain helpful data on impeller selection; sizing; best type of vessel; valuable installation and operating hints; complete description of LIGHTNIN Mixers.

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc.

131 Mt. Read Blvd., Rochester 11, N. Y.

In Canada: William & J. G. Greey, Ltd., Toronto 1, Ont.

- ☐ DH-50 Laboratory Mixers
- ☐ B-75 Portable Mixers (electric and air driven)
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller type)
- ☐ B-104 Side Entering Mixers
- ☐ B-106 Condensed Catalog (complete line)
- ☐ B-107 Mixing Data Sheet

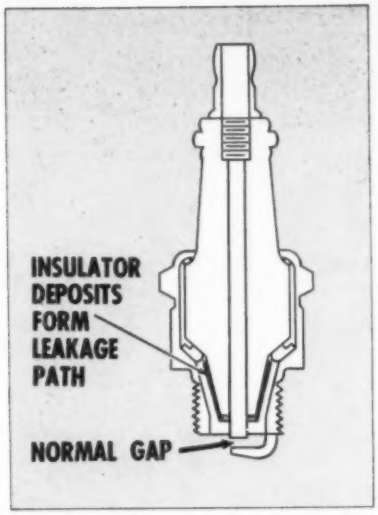
Please send me the catalogs checked at left.

Name_____ Title_____

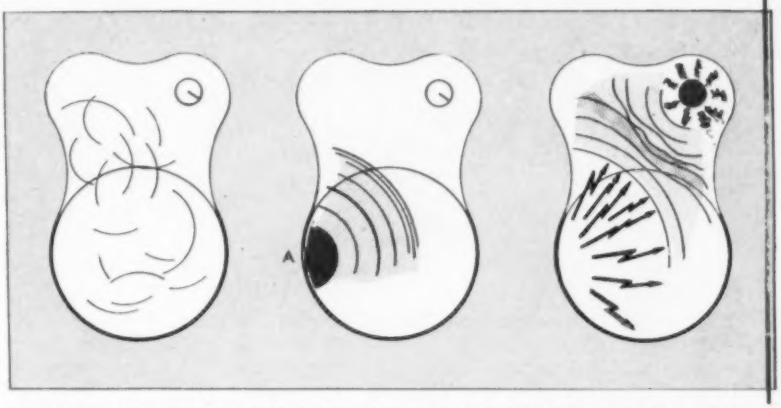
Company_____

Address_____

City_____ State_____



SPARK PLUG FOULING is caused by combustion deposits on the insulator which form a leakage path for the spark current



PREIGNITION occurs when a deposit in the combustion chamber becomes incandescent. A "hot spot" such as at "A" ignites the fuel-air mixture prior to the spark plug doing so, and the two flame fronts then compress the unburned gases between them until they detonate

TWO PROBLEMS

Spark Plug Fouling—Preignition

AND WHAT THEY MEAN

TWO problems giving refiners cause for concern today are spark plug fouling and preignition—both the result of combustion chamber deposits.

What is the nature of these deposits, what effect do they have, and what can refiners do about them? These questions have been the subject of intensive research in recent years by many companies—including the Ethyl Corp. and Shell Oil Co., both of which last year came out with new gasoline additives aimed at licking the trouble.

In recent talks which the technical representatives of Ethyl have been giving to refiners around the country, here's how they explain the situation:

Antiknock additives, sulfur and oxygen react in an engine during combustion of the fuel to form various compounds. Most of these pass through the engine and go into the exhaust. Under low speed, low temperature conditions—such as prolonged city driving—certain of these compounds deposit in the combustion chambers and on spark plug insulators.

Spark plug fouling results from a characteristic of these deposits. Normally they are non-conductive, but under certain critical conditions, particularly as they heat up during acceleration and high speed driving, they lose their electrical resistance. As a result, the current that should fire across the spark plug gap leaks away—and the plug misfires.

This condition has become more serious in the newer high-output, high-compression engines for two reasons:

First, the new V-8 engines operate over a wider range of power output, and this means that the spark plugs must function over a much wider range of temperatures. Consequently, a plug that works well at high speeds is likely to accumulate insulator deposits under city driving conditions—deposits which can eventually cause the spark plugs to misfire.

The second reason is that the higher compression pressures developed by the new engines require that a higher voltage be available to jump the spark plug gap. At these higher voltages an electrical leak becomes more critical.

There are certain chemicals which can change the character of these spark plug deposits by converting them to compounds which have less tendency to cause spark plug fouling.

Preignition is the other important problem. It was originally thought that the new engines might be relatively free from the preignition problem, but such has not proven to be the case. It now looks as though preignition may be more of a limiting factor than ordinary knock in the development of engines for further improvement in fuel utilization.

Here it might be a good idea to explain briefly

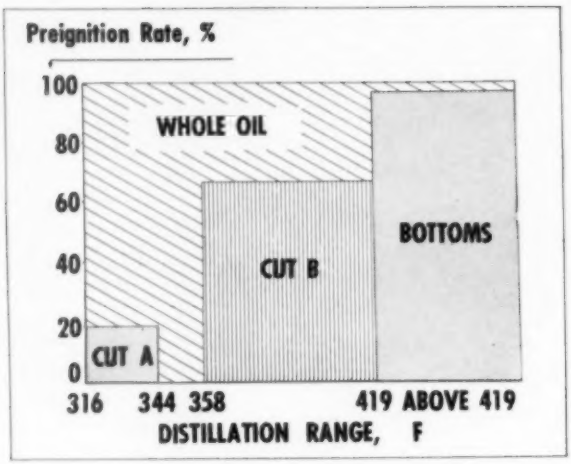


FIG. 1—The effect of oil volatility on preignition

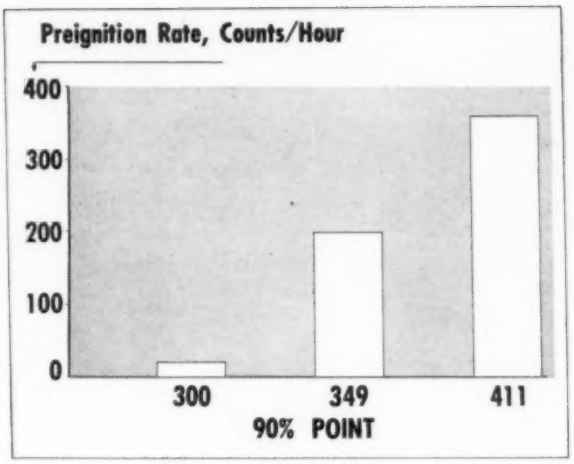


FIG. 2—The effect of fuel volatility on preignition

the difference between preignition and knocking.

Knocking occurs when the following sequence of events takes place: The mixture of gasoline and air is ignited by the spark plug at the proper time; the burning gases compress the unburned gasoline-air mixture; the temperature and pressure of the unburned gases get too high for the antiknock value of the fuel being used—and then the unburned portion of the charge detonates or knocks.

Preignition occurs when the gasoline-air mixture in the combustion chamber is ignited by some source other than the controlled spark jumping across the gap of the spark plug. Preignition can be caused by spark plugs that are too hot, by overheated valves, or by anything that ignites the charge prematurely.

The most common type of preignition in passenger car engines is that caused by engine deposits. When this type of preignition takes place, the unburned charge is ignited by deposits in the combustion chamber which have become incandescent, and may be ignited regardless of when the spark plug fires.

When this kind of ignition occurs, the effect may be like a badly overadvanced spark, and combustion gets completely out of control. The loud, irregular, sharp knocking that often has become generally known as preignition or wild ping.

Although it isn't knock in the commonly accepted sense, the motorist classifies preignition as knock. He is interested in eliminating the symptoms —regardless of the cause—and he doesn't care much what the noise is called in technical circles. The service mechanic can take out ordinary knock by retarding the spark, but in the majority of cases this adjustment will not take out preignition.

Overcoming preignition can be accomplished—in whole or in part—by several factors, the Ethyl engineers point out.

Fuel antiknock quality can affect the noise resulting from preignition, just as it does ordinary knock. In other words, the knocking that results from preignition can be quenched if a fuel of sufficiently high octane number is used.

The antiknock value of a motor fuel therefore has two jobs to do in an engine that is prone to preignition. It has to overcome ordinary knocking and also the knock caused by preignition. Or, expressed in another way, we can think of an engine as having two different fuel requirements—its ordinary knock requirement and its preignition requirement. Both of these requirements can be satisfied by octane numbers in the fuel.

Octane numbers that prevent knocking can be utilized by high compression engines to produce more power and to improve economy, and therefore are economically justified. Such is not the case, however, with the octane numbers needed to suppress preignition. These octane numbers are needed to overcome a condition which is not related to engine efficiency. Hence, they might be looked upon as octane numbers that are wasted.

Other ways to overcome preignition can be employed, aside from the provision of "excess" octane numbers in the fuel.

Engine design can help. The design change which probably has had the greatest effect has been the industry-wide swing from L-head to overhead valve engines. In the overhead valve engine the combustion chamber is more compact and has a smaller surface area—on the order of 29 sq. in. of area in a typical over-head valve engine as compared to 38 sq. in. in an L-head engine. Therefore, less deposit is available to cause preignition. However, as compression ratios went up, it was found that even this lessened exposure was sufficient to cause preignition.

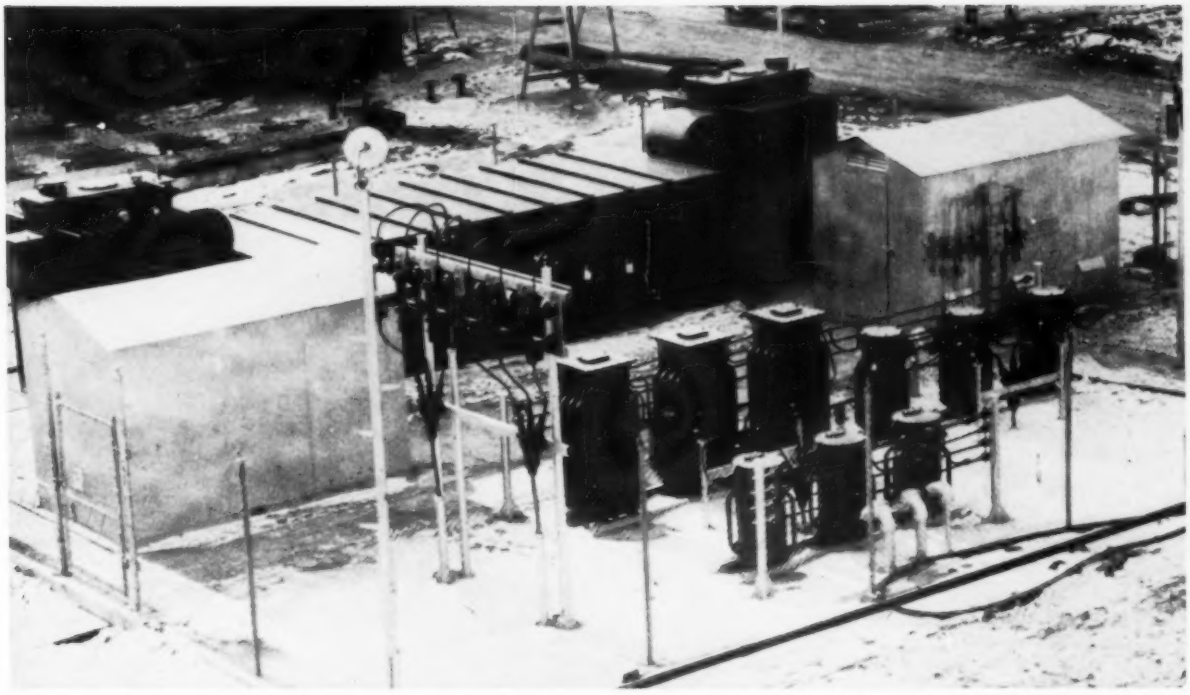
On the subject of engine design, two of the avenues of approach to future improvements in fuel utilization will undoubtedly be increased compression ratios and leaner air-fuel ratios—both of which lead to more preignition.

Changes in volatility of both gasoline and oil can also affect preignition. Fig. 1 shows what happened in the Ethyl laboratories when research technicians used various cuts of a lube oil in the crankcase and tested for preignition. The tests were conducted with a commercial grade gasoline in a single cylinder engine. Note that the more volatile Cut A produced much less preignition than the intermediate Cut B, or the Bottoms, or the Whole Oil.

The effect of fuel volatility is shown in Fig. 2. Here the Ethyl men tested a gasoline cut back to different 90% points, with definitely less tendency to preignition at the lower volatilities.

Another solution to the problem of minimizing preignition is the use of gasoline additives. When these additives are present in the motor fuel they act to prevent the incandescence in the combustion chamber deposits — and thus to reduce preignition. These same additives, as previously noted, also serve to alter the nature of the deposits on the spark plugs to prevent their fouling.

The use of suitable preignition suppression additives in a fuel lowers the preignition requirement of modern automotive engines below their ordinary knock requirements. Therefore, the refiner need not add excess octane numbers just to overcome preignition. This factor is particularly important at today's octane number requirements.



TYPICAL INSTALLATION of outdoor metal clad switchgear is this catalytic cracking unit substation at Marcus Hook

ADVANTAGES FOR YOU IN

Outdoor Metal Clad Switchgear

By EARLE R. HOYLE, Electrical Engineer
Sinclair Refining Co., East Chicago, Ind.

OUTDOOR metal-clad switchgear can be, and is being, used successfully in the distribution of electric power in refineries. Sinclair Refining Co.'s own experience, dating back some seven years in the case of the oldest such installations, has shown there are a number of advantages.

1—Less field labor is required because the units come completely assembled from the manufacturer's plant.

2—No building is needed for protection of the units.

3—A smaller area per kva is required as compared to other types of outdoor or indoor substation equipment.

An important point to remember is that careful study should be given to the location of the switchgear with respect to present and future hazardous locations.

The purpose here is to summarize briefly our company's experience with this type of installation at the various refineries, each located in a different geographical area, with correspondingly different atmospheric and other conditions.

For example: during World War II, the company purchased a refinery near Corpus Christi, Texas, which was being modernized. This plant has a design crude capacity of 28,000 b/d, 10,000 b/d thermal capacity (of which 3000 b/d is reforming), and a 12,000 b/d Houdry catalytic cracking unit.

In connection with the modernization program, a 69 KV to 2400 volt outdoor substation was installed, the power being purchased from the local utility at 69 KV. The 69 KV section of the substation consists of a six-pole structure, oil circuit breakers, and associated equipment for two incoming feeders with a bus sectionalizing switch. It is an outdoor type, 2400-volt unit substation, consisting of two transformer breakers, five feeder breakers and a bus tie breaker. Two 3000/3900 kva transformers, 69 to 2.4 KV, make up the complete substation.

This plant had been put in during the war when we were restricted in materials. Consequently, circuit breakers were omitted on the 69 KV side of the transformers. The 2400-volt circuit breakers were rated 50,000 kva interrupting capacity. So as not to exceed this rating, the 2400-volt bus tie breaker is normally open.

For continuity of service, automatic transfer switching was incorporated to transfer the station to the emergency circuit, if for any reason the circuit breakers on the preferred circuit open either at the refinery or power company's substation. No difficulty has been experienced with this automatic transfer.

This was Sinclair's first experience

ANOTHER OUTDOOR UNIT is this crude still and fractionator substation at East Chicago

with outdoor metal-clad switchgear. Because it is subject to fumes from nearby chemical plants and Gulf Coast atmospheric conditions, some apprehension was held as to the service that could be expected from the metal-clad equipment.

After seven years' operation, the only difficulties were several outages caused by insulator flashovers on the 69 KV structure. Washing the insulators with a water spray system has reduced the number of flashovers. The 2400 volt, metal-clad switchgear has given 100% service. That is, no failure of the various component parts has occurred which could cause an interruption to service.

In the latter part of 1946, a modernization program was authorized for the East Chicago, Ind., and the Marcus Hook, Penna., refineries. The electrical load for East Chicago was increased to 7500 KW, plus existing load of 5000 KW, a total of 12,500 KW. Marcus Hook was increased to 3500 KW, plus existing load of 4000, a total of 7500 KW.

Existing substations at both refineries had been installed during the early 1920's. They were brick buildings with indoor type equipment. Later additions to these substations increased short circuit duty of the existing circuit breakers to the nameplate rating and, in some cases, to above nameplate rating. With these conditions in mind, it was decided that new substations be installed, close to load areas with feeders from the power source, rather than rebuild the existing substations.

At East Chicago a generating station was built of 18,000 KW capacity, and operating at a voltage of 11.5 KV. Service from the local utility was discontinued. This simplified the new distribution system, which operates at 11.5 KV to load areas, and is stepped down to 2400 volts for use in process units.

Generator neutral is grounded through an 11 Ohm resistor, therefore ground relaying is included on the 11.5 KV circuits.

Because of the success with outdoor metal-clad switchgear at Corpus Christi, the decision was made to use this type of equipment for the new East Chicago load areas: Fluid catalytic cracking unit; stills area, and crude unit and straight run fractionator. Indoor metal-clad gear is used in the generating station.

The Fluid unit substation consists of 11.5 KV and 2.4 KV outdoor metal-clad units and two 2000 kva transformers, 11.5 to 2.4 KV. The 11.5 KV unit has four feeder sections, two for feeders from the generating station, two to the still area, and two transformer sections. The 2.4 KV unit has two transformer sections and four feeder sections.

Phase and ground directional relays are provided for the 11.5 KV incoming feeders from the generating station. The two 11.5 feeders to the still area have phase and ground overcurrent relays. The transformer sections have differential relays for transformer protection with overcurrent relays for overload protection. Each feeder has an ammeter. A voltmeter to check bus voltage is located on one transformer section.

The 2.4 KV feeders have phase overcurrent relays. Each feeder has an ammeter and watthour meter. The 2.4 KV transformer sections have an ammeter. Phase overcurrent relays are provided to protect against 2.4 KV bus faults.

The stills area substation consists of two 3750/4685 kva transformers, 11.5 to 2.4 KV; and 2.4 KV outdoor metal-clad units assembled as a double-ended unit station. A circuit breaker is provided on each 11.5 KV incoming feeder. This circuit breaker is located adjacent to its respective transformer. The 2.4 KV unit consists of two transformer sections and six feeder sections. The 11.5 KV incoming feeders have directional overcurrent relays and voltmeter for voltage indication. Included with the feeders are differential relays for transformer protection.

The 2.4 KV feeders have phase overcurrent relays and an ammeter. Three of the feeders have a watthour meter. The transformer units have overcurrent relays and an ammeter. A voltmeter is included to indicate bus potential.

Crude unit and straight run fractionator substation consists of 11.5 and 2.4 KV outdoor metal-clad units and two 6000/7500 kva transformers, 11.5 to 2.4 KV. The 11.5 KV unit has two feeder sections and two transformer sections. The 2.4 KV units are two radial sections, each connected to a transformer. One unit has one transformer section, four feeder sections, and a bus tie section. The other has one transformer section and five feeder sections.

Phase and ground directional relays are provided on the 11.5 KV incoming feeders. The transformer units have overcurrent relays for transformer protection. Each feeder and transformer unit has an ammeter. A voltmeter is included for bus voltage indication.

The 2.4 KV transformer sections have overcurrent relays, differential relays and an ammeter. A voltmeter is included for bus potential indication. The bus tie section has overcurrent relays and an ammeter. Each feeder section has overcurrent relays, ammeter and watthour meter.

At the Marcus Hook refinery, outdoor metal-clad switchgear at the main substation consists of six sections; two incoming feeders, two auxiliary and two feeders to the Fluid catalytic cracking area. The two incoming feeder sections are for preferred and emergency circuits from the local utility. One auxiliary section is used for utility company metering equip-

ment. The other auxiliary section has potential transformers and relays for automatic transfer of preferred feeder to emergency feeder in the event of trouble.

Incoming feeders have phase and ground overcurrent relays and an ammeter. Feeders for Fluid catalytic cracking area have phase and ground overcurrent relays and an ammeter.

The substation at the catalytic cracking area consists of a double-end unit with two 2000/2300 kva transformers, 13.2 to 2.4 KV. The 2.4 KV section comprises two transformer sections and six feeder sections. Each transformer has an oil-immersed disconnect for isolating the incoming 13.2 KV feeder. This disconnect is interlocked with the 2.4 KV transformer breaker to prevent its being opened under load.

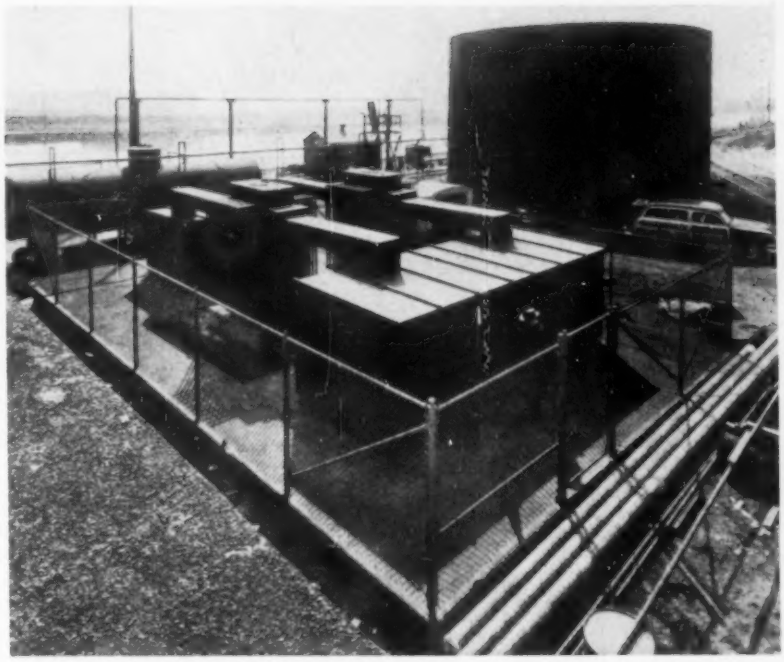
Each 2.4 KV transformer section has directional relays and an ammeter. A voltmeter is included for indicating potential on transformer. Each of the six feeder sections has overcurrent relays, an ammeter and watthour meter.

At the present time in Marcus Hook, another 13.2 KV outdoor unit is being installed and is expected to be in service in the near future. It consists of two incoming line sections, three transformer sections, one feeder section and two auxiliary sections. Auxiliary sections are for utility metering and automatic transfer relays and potential transformers.

Automatic transfer of the incoming circuits is required by the utility, as they would not allow parallel operation until total load on the feeders reached a capacity of 12,000 kva. There are two preferred incoming circuits which will feed two separate sections of switchgear, and an emergency line which is tapped to the existing substation and will have a tap to substation now being installed. Proposed electric load requirements for the coming year will be such that parallel operation of the feeders can be effected.

An expansion program now under way at the Houston refinery will include two new substations: one a 69 to 12 KV station with three 12,500 kva transformers; the other a 12 to 2.4 KV station with three 5000/6250 kva transformers. These stations were scheduled for operation the latter part of 1953.

In 1952 there was installed at the Wood River refinery, Hartford, Ill., a 2.4 KV outdoor metal-clad switchgear unit, consisting of one transformer section and five feeder sections. The transformer section has overcurrent and differential relays, an ammeter and a voltmeter for bus voltage indication. The feeder sections have overcurrent relays, and ammeter and watthour meter. This switchgear is fed from a transformer owned by the local power company.



AN EARLY OUTDOOR UNIT is this cracking plant substation at Sinclair's East Chicago refinery

All power circuit breakers are of the oil-immersed type with suitable interrupting capacity and are DC operated. Standard 125-volt batteries are located in buildings near the substations, which also house space circuit breakers, test racks, and accessories.

Lower costs were found for the installation of outdoor metal-clad switchgear than for other types of outdoor substations in the 13.2 and 2.4 KV ranges. Considerable time was saved on actual installation, which is an important factor during a refinery construction program.

Manpower requirements run approximately 35 to 40% less than for other types of outdoor installations. The fact that outdoor switchgear requires no buildings is itself a major consideration. Switchgear near process units is located at least 100 feet from areas designated as hazardous.

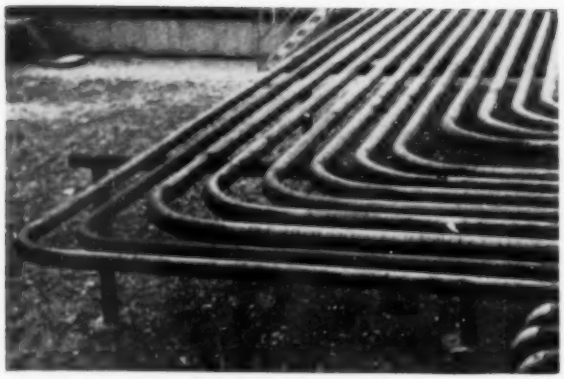
Corrosion does not seem to be a serious problem. For example: the substation in the stills area at East Chicago was installed adjacent to an existing indoor substation. The refinery is crowded for room, and there is a fairly large cooling tower—with 18 fans in it—less than 50 ft. from this particular station.

On some days in the winter, we get such a fog over the cooling tower and surroundings that it's virtually impossible to see the substation. That gear has been operating under those conditions for the last five winters. Yet so far we have had no difficulty from corrosion or dampness. All the outdoor metal-clad switchgear units are equipped with space heaters to keep the inside temperature a little above that on the outside. This protection is a Sinclair requirement.

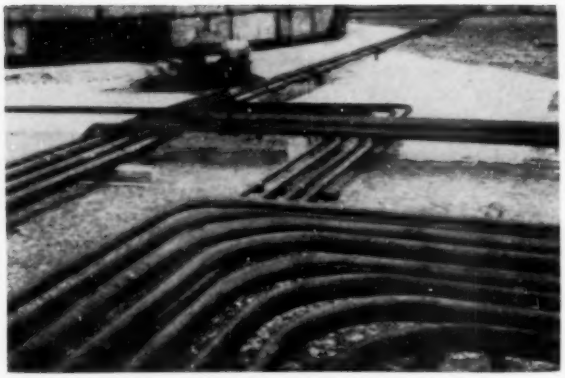
Conditions are probably worse at the refinery at Corpus Christi than at any of the other plants. The neighbor across the fence is an alkali plant. Nearby is a large cement plant. Salt air permeates the entire area. We use a water spray system to wash the insulators once each day on the 69 KV section of the substation.

The maintenance department personnel was at first apprehensive at the prospect of having to service this type of equipment during winter months. Now, after five years' operation at both East Chicago and Marcus Hook, the department has expressed a preference for the outdoor metal-clad equipment. Thus far, the major portion of maintenance has been on the painting of the outside housings.

A good coating which would eliminate the need for painting is desirable for saving manhours in the refinery. Perhaps such a coating will eventually be developed by the switchgear manufacturers. Operation to date of switchgear has been reliable in every respect, except for a few minor adjustments at the time of installation.



FOR FOAM LINES



OR TRANSFER LINES

Why Not Bend That Pipe?

With smaller diameters—say 4-inch—you can speed up installations as well as save money on fittings

By WILMER R. SCHUH, Chief Engineer,
E. D. Wesley Co., Milwaukee, Wis.

BENDING pipe made possible a saving of over $800 in materials and 270 man-hrs. in the installation of 22,074 ft. of transfer lines and a foam system connecting four oil storage tanks recently at the Jones Island terminal of the Wisconsin Petroleum Terminals, Inc. In addition the job was finished 10 days ahead of the 90-day contract time.

The project consisted of four tanks, three of them 42 ft. high x 75 ft. in diameter, and the fourth one 90 ft. in diameter at the same height. Our decision to use pipe-bending equipment was based on about 10 years of experience with it and the knowledge that besides the economic advantage, the installation would be more efficient and pleasing to the eye.

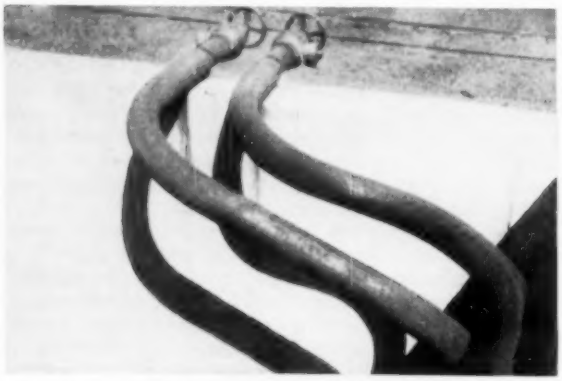
At the start, we tried to use inexpensive pipe benders with short formers and short rams. These were impractical because of the pipe sizes involved in the job—3 and 4-inch. It was necessary to move the pipe too many times to make a 90° bend.

When we changed to a heavy duty bender with half-circle shoes and long ram, we found we could make identical bends in single settings in just a few minutes, in any arc up to 180° and with very little operator training. The unit we used was the Tal Bender Co.'s "One Shot" model.

The complete bending job was concentrated on the following sizes of pipe: 10,020 ft. of 4-in. and 3983 ft. of 3-inch used as foam lines for the tank fire protection system; 1234 ft. of 4-in. product line used to load tank cars; and some 380 ft. of 2-in. product lines.

Altogether, about 135 bends were made from 90° down to 12°, along with 32 offsets—eight on the 4-in. pipe and 24 on the 3-in. pipe. One of these was a 40-ft. length which we bent in a rolling offset of 15° and 90°. At the other extreme, we made bends in pipe only four ft. long.

One feature about bending pipe that appealed to us was that we were unlimited in the direction which could be taken or in the offset which could be made. On the other hand, had we used welded fittings, we could have



BENDING THE OFFSETS ELIMINATED four fittings and eight welds in these foam lines

WELDING WOULD HAVE BEEN TOUGH in a cramped spot like this where bends were an easy installation

used only 90° or 45° fittings, with some of them trimmed.

This meant that in just one offset, two fittings were saved and four welds with their higher cost were eliminated.

Savings of about 75% were what we got on the 3 and 4-in. bends over what welded ells would have cost. We figure a 90°, 4-in. welded ell would be $16, and a bend at only $3—that's $2 for the labor and $1 for the pipe. For the 3-in. size, the welded ell would be $13 and the bend only $2.50—$1.90 for labor and $0.60 for the pipe.

In the case of a 45° welded ell; the cost runs $15 for the 4-in. and $12 for the 3-in. By comparison, approximately the same cost holds for the bends at 45° as those at 90°—$3 and $2.50 respectively.

The basis for figuring these bending costs is as follows. It takes at least 2 hrs. to fit up and weld a 90°, 4-in. ell, whereas the bend could be set up and measured in 45 minutes with the actual bending time at 2 minutes. A 90°, 3-in. welded ell would take about 1¾ hrs. to fit up and weld while bending the same job would be 35 to 45 minutes to set up and measure and 54 seconds for the actual bending.

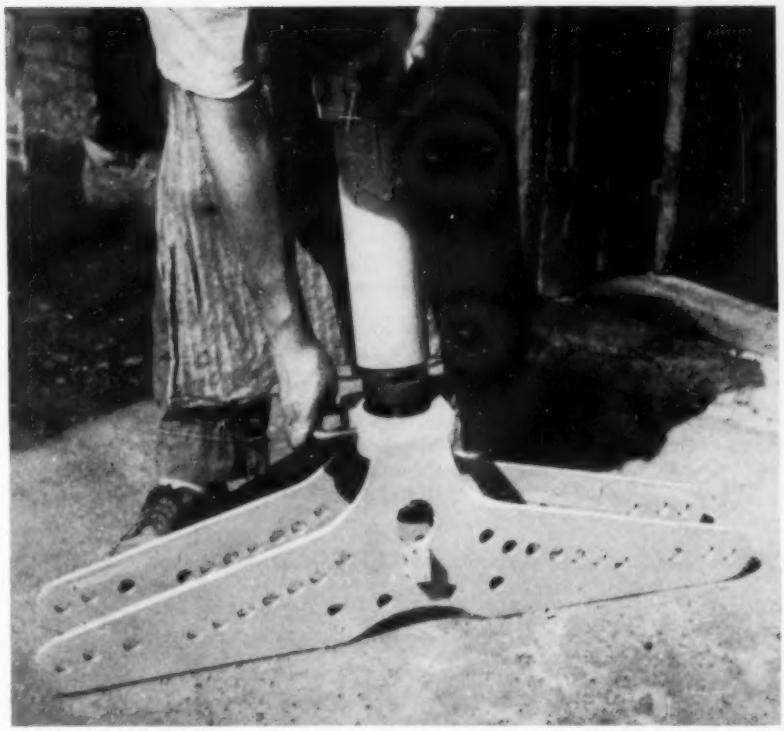
Another point to remember: the time and costs quoted above are with the idea in mind that pipe benders are being used on the job, in the field—rather than buying pipe that is already bent. Cost in the latter instance would be considerably higher.

For example: two men can set up, measure, make, and install six 90° bends in 6-in. pipe in eight hours for a labor cost of about $50. That same pipe bought already bent incorporates in its cost a figure of $150 for the labor of bending alone.

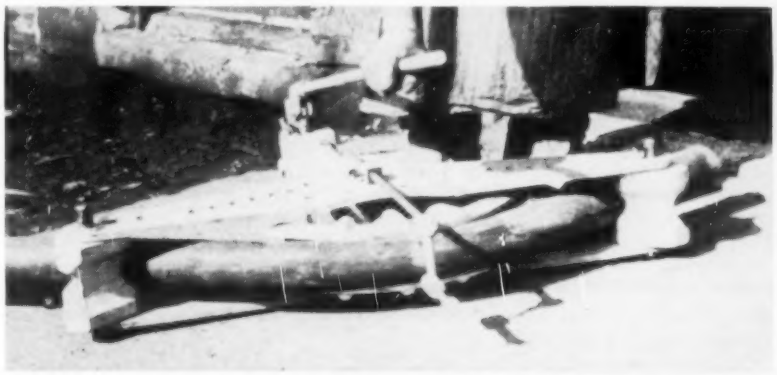
There is still another saving made in bending pipe besides the factors of ells, welds, and time. The salvage rate on what would otherwise be scrap pipe is almost 100%.

To illustrate: with a 45° or a 90° ell, a mechanic will take enough pipe for the requirement and cut off the excess. The cut-off portion becomes scrap most likely. With a bend, the sweeping curve, rather than a direct right angle, actually extends the length, and a mechanic will weld on a scrap piece to make the desired total length. During the work on the oil terminal installation, we didn't have a single bend go wrong that we couldn't salvage.

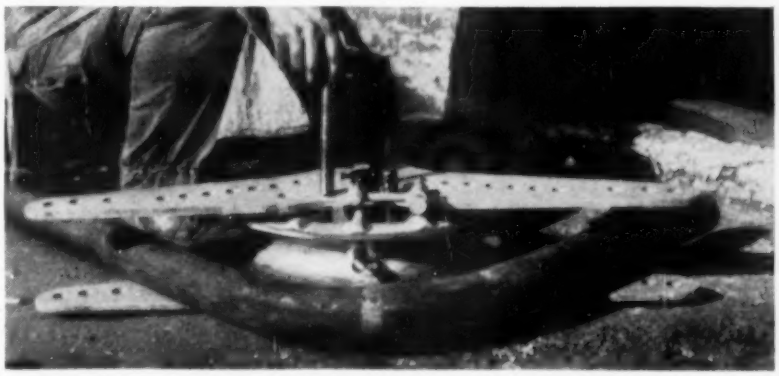
In the storage terminal, the pumps operate at 75 psi. on the 4-in. product lines used to load tank cars. There is little pressure loss in smooth-walled pipe bends. These smooth curves also lessen turbulence and eddy currents which create flow resistance and tend to affect pressure drop.



BENDER ASSEMBLY IS SIMPLE: only two main parts, hydraulic cylinder and frame, are put together in less than a minute with a U-key



SINGLE SETTING is all that is needed for making a 45° bend: the pipe does not have to be shifted along the bender



FINISHED BEND, 90° size: pipe and shoe were fastened to frame, then pipe was released with the push-out pin

TOPS in "What's New!"—1953

Here are brief repeats of the most interesting items reviewed in the monthly "What's New!" section during the year just ended. As a service to readers who might have missed them, may not have been receiving PETROLEUM PROCESSING, or may find them of value in their work, the editors have assembled the "Tops in What's New!—1953" on this and the following page.

A code number has been assigned to each item. You are invited to use the regular Reply Cards, which you'll find between pages 128 and 129, to request further information about equipment or copies of the helpful trade literature.

Transistor Applications

Discussion in 24-page booklet of how transistors were developed, how they're built and used in modern industry, and what can be expected from them in the future. Radio Corp. of America, RCA Bldg., 30 Rockefeller Plaza, New York 20, N. Y.

Circle No. **1** *on Reply Card*

Caustic Soda Data

Information on grades, manufacturing processes, analytical methods, shipping, handling precautions, containers, materials of construction for storage tanks, etc., in 56-page booklet. Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich.

Circle No. **2** *on Reply Card*

The Importance of Emptiness

Vacuum—the Magic Hat of Industry, a 12-page booklet written in non-technical language about the uses of vacuum and the methods of producing it. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Circle No. **3** *on Reply Card*

Bubble Tray Design

Twelve pages of diagrams and text, dealing, among other things, with the advantages of the manufacturer's Truss-Type construction. Fritz W. Glitsch & Sons, Inc., P. O. Box 6227, Dallas 2, Texas.

Circle No. **4** *on Reply Card*

Anhydrous Ammonia

A guide to the use of this compound in cylinders, described in 20-page manual, with physical and chemical properties, specifications, applications, handling techniques and safety precautions. Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Circle No. **5** *on Reply Card*

Insulation Specs for Refineries

A 52-page brochure gives specifications for insulation for service above and below 100° F., for tanks, and for oil heaters; including thickness recommendations in seven tables. Johns-Manville, 22 E. 40th St., New York 16, N. Y.

Circle No. **6** *on Reply Card*

Tube Corrosion

Condenser and Heat Exchanger Tube Handbook; 56 pages dealing with tube corrosion in condensers and heat exchangers; deals with properties of copper-brass condenser tube alloys and applications in industry plus studies on corrosive effects. Bridgeport Brass Co., Bridgeport 2, Conn.

Circle No. **7** *on Reply Card*

Catalytic Cracking

A record of operations involving use of the Houdriflow process in 10 commercial installations over the past two years, with tables showing typical yields and operating data, a description of the process and a cutaway drawing of a Houdriflow unit. Houdry Process Corp., 1528 Walnut St., Philadelphia 2, Pa.

Circle No. **8** *on Reply Card*

Temperature Measurement Principles

The Design and Process Engineer's Guide to Industrial Temperature Measurement and Control; booklet discusses eight ways of responding to temperature, five ways of putting those responses to work, and nine instrument types of the manufacturer. The Partlow Corp., New Hartford, N. Y.

Circle No. **9** *on Reply Card*

Acetylene from Hydrocarbons

A 24-page report discusses the Wulff Process, with process description and simplified flow diagram, plus data on plant and manufacturing costs. The Lummus Co., Room 359, 385 Madison Ave., New York 17, N. Y.

Circle No. **10** *on Reply Card*

Pump "Squeezes" Fluids Through

A series of chrome-plated steel "fingers" simulate the action of the human hand by "squeezing" fluid through flexible tubing in the new "Sigamotor Pump." Designed to eliminate corrosion and/or contamination problems, the device permits no contact between fluid being pumped and the working parts. Pump mechanism has a hinged top so tubing can be simply placed in position without disconnecting either end. Sigamotor will pump liquids, gases, or solids in solution. It will handle from 45 to 250 gph. at an operating speed of 500 rpm. Different tubing sizes can be used simultaneously. Several fluids may be pumped in proportion, simultaneously and independently. Tubing recommended for use in the pump can be supplied by the manufacturer. Aluminum case is 12 in. high and has a 5-in. pulley on the side. Sigamotor, Inc., 504 N. Main St.. Middleport, N. Y.

Circle No. **11** *on Reply Card*

Device Measures Weight Flow Only

Use of this instrument, which measures flow rate in lb./min., yet is insensitive to other factors such as temperature, pressure, viscosity, compressibility, etc., is said to eliminate control problems in getting accurate flow measurements. Mass rate of flow is measured by determining the moment necessary to give the mass a Coriolis acceleration. The fluid stream is forced out radially by its own velocity, while the path of any given particle is a spiral, because the sensing element and flowmeter case are rotating. To obtain velocity change, mass of the particle has to be accelerated. Measurement is then made by the amount of twist in the torque tube, or the phase shift between sensing element and rotating case. The unit can be used with homogenous fluids, will read flow in either direction and has a high speed of response. Control Engrg. Corp., Norwood 209, Mass.

Circle No. **12** *on Reply Card*

Tiny Flowmeters Permit Small Flow Control

Typical applications of the "S&K Purge Rotameter" include indication of: (1) flow of supply air in bubbler type liquid level measuring installations; (2) flow of purge fluid, generally water or air, in the lines connecting orifices, venturi tubes or nozzles to differential head flowmeters; (3) flow of transparent purge fluid to sight glass indicators of Rotameters measuring the flow of opaque liquids; (4) flow purge fluids to indicator extensions of indicating Rotameters or to extension wells of Rotameters with electric or pneumatic transmitters where the process fluid carries slurries; and (5) flow of sample fluid to measuring installations for continuous chemical analysis of fluids. Small size, variable area meters for low ranges, the meters include a back flow check valve. The units must be installed vertically. Schutte and Koerting Co., Dept. M-C, Cornwells Hts., Bucks County, Pa.

Circle No. **13** *on Reply Card*

Records Liquid Density Continuously

"Princo Densitrol," which compensates automatically for temperature variations, can be obtained in any calibration within limits of 0.2 to 0.005 density, or equivalent full scale range within the limits 0.5 to 3.5 density or equivalent. Accuracy for all ranges is ±3% of range or 0.0002 density, whichever is greater. Sensitivity for all ranges is ±0.5% of range. Sensing element is a totally submerged plummet, fastened by a chain to a fixed reference point. For each density within the range of this assembly, the plummet assumes a definite equilibrium position. Changes are translated through plummet core and electrical position measuring device into indication, recording or control. Units can be used at temperatures up to 350° C., and models are available for operating pressures up to 600 psi. Precision Thermometer & Instrument Co., Dept. 7, 1434 Brandywine St., Philadelphia 30, Pa.

Circle No. **14** *on Reply Card*

Analyzes Oxygen Content in 10-30 Sec.

This portable oxygen analyzer for aqueous solutions is not subject to interference by dissolved iron, calcium, magnesium or organic matter, as is the case with the usual Winkler test. It is said to be suited for field use in checking oxygen content of sewage or brines, or in the laboratory on chemical processes. The instrument uses an amperometric principle in which minute traces of dissolved oxygen are reduced at a rotating platinum cathode. The electrode assembly is built on a detachable frame that can be used for other analyses if desired. Sample to be analyzed is placed in a plastic container which is then attached to the instrument. This provides a meter reading which is converted to ppm. of dissolved oxygen by means of a calibration chart. Dorber Co., 7741 W. Palatine Ave., Chicago 31, Ill.

Circle No. **15** *on Reply Card*

Reagent Finds Water Traces Without Heating

"Mois-Tec" detects water traces in many petroleum products without heating, by adding the material drop by drop to a given quantity of sample until a blue-green endpoint is reached. Each drop of the compound is equivalent to 0.2 mg. of water. It is said to be suitable for use with gasolines, oils, greases, solvents, polyglycols and derivatives. Manufacturer states it will not work with glycerine, acetone, ethylene or propylene glycols, methyl, ethyl or isopropyl alcohols. R. P. Cargille Laboratories, Inc., 117 Liberty St., New York 6, N. Y.

Circle No. **16** *on Reply Card*

For news about current new products, equipment, processes or literature please turn to the regular "What's New!" section in this issue, beginning on page 129.

NEW VENT VALVE as installed on top of a cone roof storage tank being inspected by refinery engineers

New Vent Valve Cuts Vapor Losses

Sealed in anti-freeze, it won't fail in sub-zero weather; tests show losses can be cut 90%

A NEW vapor relief valve promising greater conservation and solution of other problems commonly associated with the venting of cone roof storage tanks has been in experimental use now for several years in an east coast refinery.

The new valve is completely sealed in an ethylene glycol-water solution and can operate at temperatures as low as —40° F. without danger of freezing.

Being completely sealed in liquid, it is not subject to leakage caused by improperly matched or warped metal surfaces.

It operates intermittently, opening to full capacity in a few seconds when tank pressure reaches the set value, and then closing completely until tank pressure rebuilds to the set value.

This latter feature minimizes vapor losses. In one test, losses from an 80,000-bbl. tank containing 7.2 lb. RVP gasoline and equipped with this new

vent valve were only a tenth of the losses from a similar tank containing the same product but equipped with conventional tank venting devices.

This development overcomes the present problem in areas where freezing weather prevails part of the year and there is the consequent danger of the tank vents becoming inoperative because of icing.

The new valve is known variously as the Rotating Vacuum and Pressure Relief Valve, or as the Sellers Burp Valve. The latter name evolved from the typical noise emitted by the device as a result of its intermittent operation. The experimental valve has recently been improved by the engineering division of Sellers Injector Corp.

The history of the valve goes back to World War II. At that time, you will recall, the "Big Inch" pipe line was laid from the southwest to the East Coast in order to safeguard our petroleum supply to the East.

The high pumping rates employed by this line made the venting equipment on receiving tanks in many cases inadequate. Consequently, it was necessary to resort to free venting until the tanks could be properly equipped. The result was greatly increased vapor loss and a greater fire hazard—conditions which made it imperative that something be done.

Years of experience indicated that the ideal vent valve should have a large venting capacity, liquid sealing, sealing body separated from liquid during operation, and intermittent operation.

A pair of vent valves was designed and constructed to meet these ideal requirements and installed on a storage tank. In spite of their monstrous appearance and crude design, they operated with exceptional efficiency.

Three more pairs of these valves were built and installed on other receiving tanks. By the time shipment through the "Big Inch" was discontinued at the end of the war, these valves had saved, by a conservative estimate, many thousand bbls. of light ends from the four tanks equipped with them.

Several minor disadvantages were apparent in these first valves, even though they worked very effectively. A pair of two separate valves was required to vent the tank for pressure and vacuum, with the vacuum one being unwieldy and bulky. Further, the rapid opening of the valve caused splashing and the loss of a small amount of the sealing liquid every time it operated. The result over a long period of continuous operation was to deplete the valves of the sealing liquid.

An improved version of the original valve has been evolved which overcomes these disadvantages and functions for both vacuum and pressure. Dual actuators were added to raise the venting capacity and to achieve a more positive and powerful opening action.

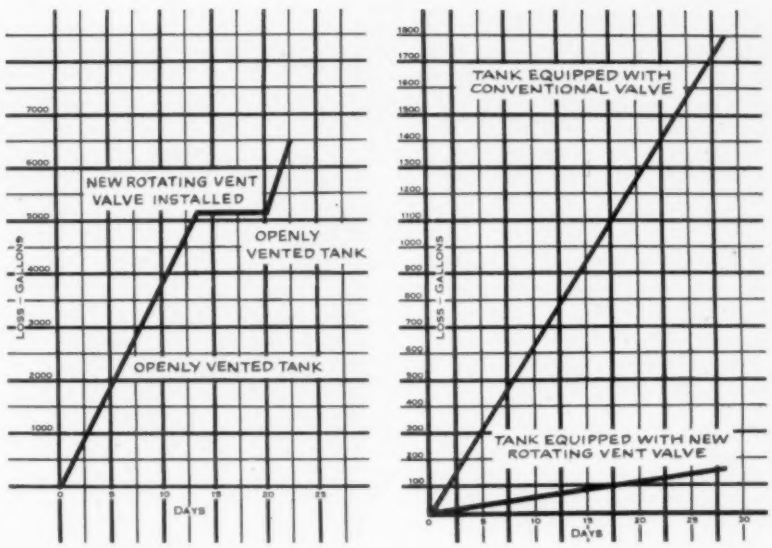


FIG. 1 and 2—COMPARISON OF LOSSES under various venting conditions. Fig. 1 (left) shows losses from a tank containing 7.2 lb. RVP stabilized gasoline stored at an average temperature of 58° F. in an openly vented tank, and in the same tank equipped with the new valve. Fig. 2 (right) shows losses from two adjacent 80,000-bbl. tanks containing the same product (average temperature 72° F.), one tank equipped with a conventional valve and the other with the new rotating valve

Selection of a suitable sealing liquid posed a slight problem. Common practice has been to use oil, but since water from condensation would sink through an oil seal and accumulate in the bottom, subsequent freezing would make the valve inoperative. A sealing liquid was needed which would absorb this condensate without freezing.

A mixture of 50% ethylene glycol and 50% water, with a freezing point of about —40° F., has proven to be ideal. There is, of course, over a long period of time some slight dilution. However, by using pure glycol for replacement, the concentration of the glycol/water solution will remain practically constant.

Theories concerning the savings actually achieved by this valve are deduced from observation, because of the difficulty of conducting tests at such a large scale. The pressure variation in a closed tank is dependent on the change in the temperature. Conventional valves, to reach their full capacity at the allowable pressure, must open at a small change in pressure. The movement of the vapors will cause a more rapid heat transfer inside the tank which, in turn, will raise the pressure still further, causing the valves to blow continuously, the vapors to be agitated, etc. This vicious cycle is practically eliminated by the new valve with its intermittent operation. The vapors will tend to come to a quiescent state between cycles.

A great number of days of the year, the temperature will not rise above a point which corresponds to a pressure of from 1 in. to 1⅜ in. water column. Therefore, with adjustable pressure controls, it is possible to set the blow-off pressure somewhat higher and still keep a perfect seal. The result is that no vapor is lost whatsoever on these days.

Efficiency of the new valve was tested when about 156,000 bbls. of low vapor pressure gasoline were to be stored in two identical 80,000 bbl. adjacent tanks having the same exposure to the sun's direct rays.

After these tanks were inspected for outside leaks, the lines leading to the tanks were blanked off, thus preventing any loss due to leaky valves. In order to determine any leaks through the bottoms, which could show up as a product loss, the water bottoms were very accurately gaged and periodically checked. Every precaution was taken to insure that no loss was possible except, of course, vapor loss.

Consecutive gages were taken with a special gage tube, which, because of its unique design, enabled the gager to bring the liquid surface to eye level, thus facilitating extreme reading ac-

curacy. The specially constructed suspension tape for the gage tube was provided with graduated stops to be placed against a fixed datum edge, to help eliminate human errors. The temperature was taken at four different levels with both an ordinary mercury thermometer and a resistance type bulb thermometer. Gaging was accomplished by three groups working independently. The results plotted from the most conservative of the three sets of data are shown in Figs. 1 and 2.

As plotted in Fig. 1, losses of approximately 400 gal./day/tank were found when openly vented. After the new vent valve was put into operation on one tank, none of the three observing groups showed any measurable loss from the tank so equipped. The valve was then taken out of operation and exactly the same losses as before were recorded for both tanks.

Coming into the warmer season, conventional valves were put into operation on one of the tanks while the new valve was operating on the other. After 38 days the conventional valves showed a loss of 2250 gal., or an average of 60 gal./day. The new valve showed 6 gal./day, or 250 gal. in 42 days. These data are plotted in Fig. 2.

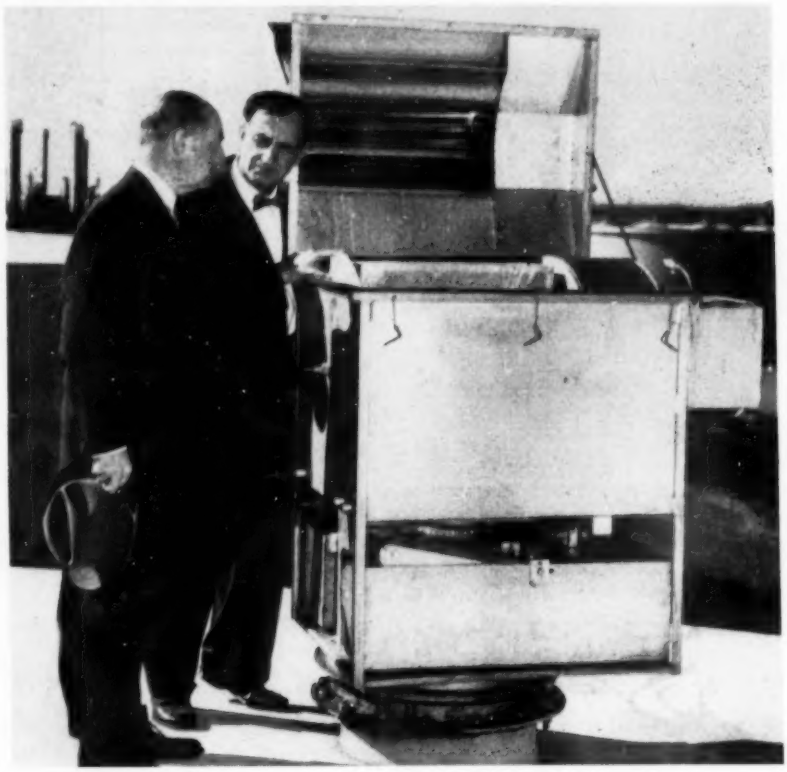
On a mid-summer day while watching these two tanks, it was noted that the new valve blew only three times, the first time being several hours after the conventional valves had begun to release continuously.

Both tanks were almost full, and consequently the vapor space (19,000 cu. ft.) was comparatively small. The vapor loss should have been relatively small as compared to, for instance, a half full tank with a vapor space of 225,000 cu. ft.

In addition to the vapor conservation feature, the valve, as now constructed, has a very large venting capacity. The last time it was observed a ship was pumping crude oil at 23,000 bbls./hour. The valve was open for 32 seconds and closed 14 seconds, with split second regularity.

The new rotating valve can be set to operate for any reasonable pressure or vacuum, and works equally well for both. Its liquid sealing insures against leaking, gumming and freezing.

The production version of the valve is shown in the accompanying photograph and an exploded view of its design features in Fig. 3. As illustrated, the valve has a rectangular duct with a minimum cross section of 120 sq. in. The valve is divided into (1) the upper section or main tank, which is filled with ethylene glycol/water and (2) a covered lower section comprising the actuating mechanisms. The valve is mounted on a base (3) and mounting flange, which both levels and attaches the valve to the storage tank.



ANOTHER VIEW of the new "burp" valve as installed on a tank roof

The upper section (1) holds the pivot-mounted rotor (1-A), consisting of the main valve (1-B) opened and closed by the plate of (1-C) receiving the pressure. Atop the main tank is a fin-shaped hood (1-D) with a side attachment (1-E), which is the liquid supply tank. The liquid level, float tank (1-F), attached to the side of the main tank, operates in conjunction with an overflow pipe to determine the correct level of the sealing solution. Any overflow is collected in tank (1-G), from which it can be drained for re-use. Projecting through the floor of the main tank are two ducts (1-H) connecting the upper section to the pressure actuating and vacuum triggers contained below.

The lower section (2) holds the actuator tank (2-A), supported by a false bottom suspended beneath the main tank. The horseshoe-shaped actuator tank contains independently operated pressure (2-B) and vacuum (2-C) actuators. This section contains its own liquid level float (2-D) and overflow pipe.

The base (3) consists of a pair of flanges, one to be attached to an API 20-in. manhead and the other permanently affixed to a cylindrical skirt attached to the valve. The skirt extends into the flange mounted on the tank. Four studs level the valve and attach it to the manhead. A small gap, provided between the skirt and tank flange to allow for leveling, is then permanently sealed with mastic filler. An especially designed flame arrestor may be inserted between the manhead and the valve.

Fig. 4 is a schematic illustration showing the major elements of the new valve. Some of the elements are shown out of position for ease of explaining their function. It will be noted that the rotor consists of a valve section and an operating section (referred to as the operator), built together to become one unit rotating about a single axis. The main Fig. 4 illustration shows a section through the operating portion of the rotor when in the closed position. Partial views show the operating section in the open position and the valve section in both closed and open positions.

The valve is held in the closed position by weights affixed to the rotor. No gases can escape from the duct past the rotor edges because of the liquid

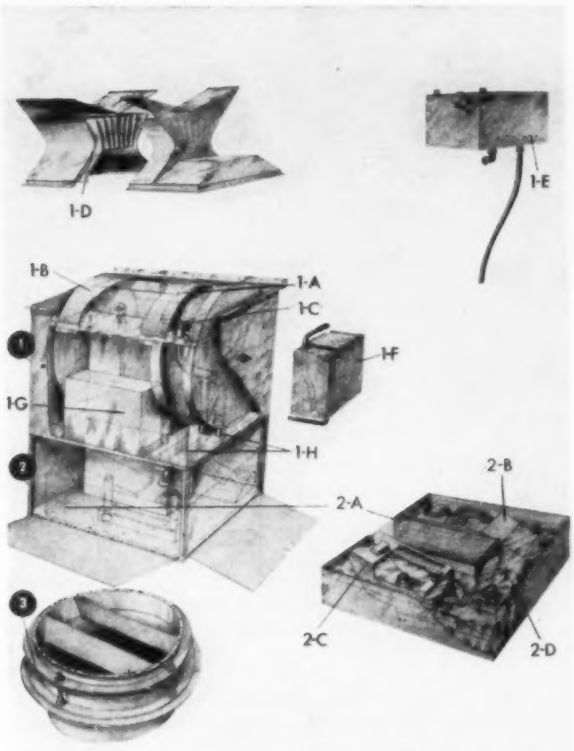


FIG. 3—EXPLODED VIEW of new vent valve, showing the main tank (1), actuating tank (2), and mounting base (3)

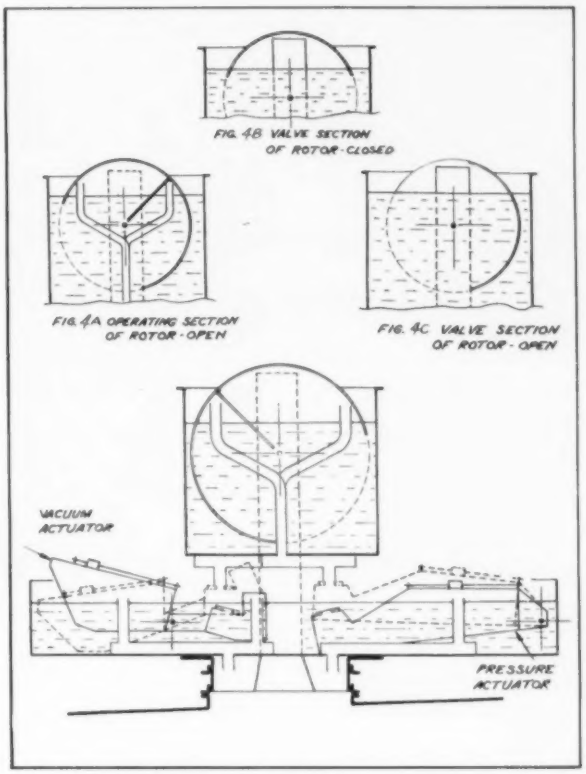


FIG. 4B VALVE SECTION OF ROTOR-CLOSED
FIG. 4A OPERATING SECTION OF ROTOR-OPEN
FIG. 4C VALVE SECTION OF ROTOR-OPEN
VACUUM ACTUATOR
PRESSURE ACTUATOR

FIG. 4—MAJOR ELEMENTS of the valve—vacuum and pressure actuators, operating section of rotor, and valve section of rotor

seal as shown above in Fig. 4-A.

It will be noted that the vapor space above the fluid seal of both the pressure actuator on the right and the vacuum actuator on the left is always at tank pressure. It will be seen from the positions of their pivots that positive pressure tends to lift the pressure actuator out of the sealing liquid into contact with the upper duct, placing the left hand chamber of the operator at tank pressure. Under these conditions, the vacuum actuator is held in the sealed position, leaving the duct system leading to the operator's right hand chamber open to atmospheric pressure. Pressure on the dividing plate between the chambers rotates the valve clockwise to the open position shown in Figs. 4-B and 4-C, allowing unimpeded flow through the main duct. The valve will remain open until the actuator returns to the sealed position. Both operator compartments are then vented to atmosphere and a weight affixed to the rotor returns it to the closed position.

When pressure in the tank becomes negative, the vacuum actuator is moved into contact with its upper duct, completing the duct circuit between the right hand operator compartment and the storage tank. The pressure in this compartment reduces to tank pressure and the higher pressure of the atmosphere existing in the left hand compartment again rolls the rotor clockwise to the open position, allowing free ingress of air.

Note that the area affecting either actuator's operation is enlarged when the actuator is in operating position. In each case, an approach toward atmospheric pressure is required before the actuator will drop out of contact with its upper duct and return to the sealed position. This effects a spread between opening and closing pressure values and, under idle storage condition, results in a long-time requirement for rebuilding the pressure to the operating value. Infrequent operation results.

It will be seen that this new design possesses certain advantages:

1—The liquid accomplishes a perfect seal, unaffected by normal manufacturing tolerances.

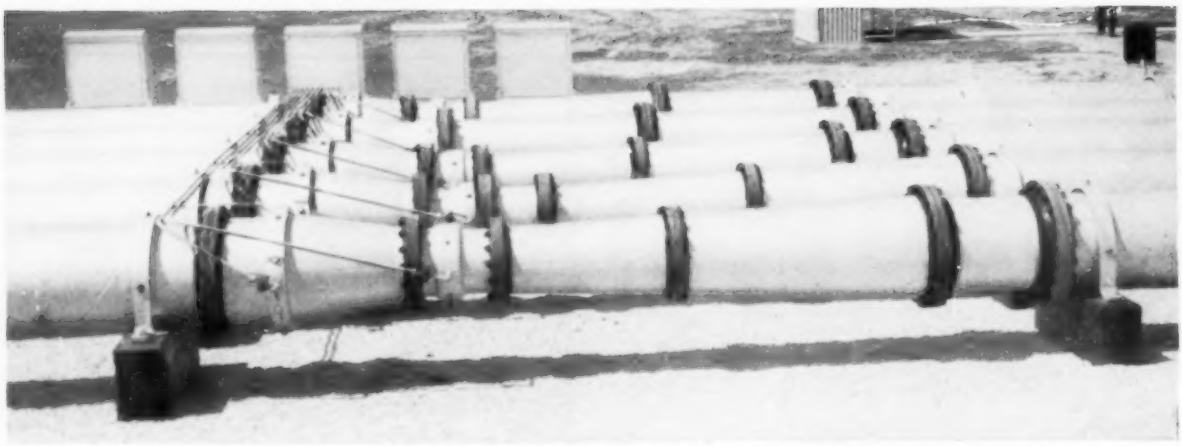
2—With the liquid level properly set, the seal is not affected by normal pressure variations within set limits.

3—All closely fitted moving parts are completely immersed in the anti-freeze solution and are subject to neither freezing nor gumming. It is an all-season valve.

4—Since the valve goes from a completely closed to a completely open condition, the settings can be chosen at the safe working pressure for the tank. Atmospheric conditions which produce venting in some valves at low pressure have no effect on the new valve. Even when pressure conditions rise sufficiently to open the new valve, it is open only for seconds. As a result, insulating bankets are maintained, less circulation occurs in the tank and stabilizes the vapor-rich layer at the liquid interface. Both evaporation and loss of vapor are minimized.

5—Since the capacity of the valve is greater than the maximum requirement for release of vapors, the valve will cycle and cut the vapor release into puffs, instead of a steady stream. This reduces the fire hazard.

6—Pressure exerted on the liquid seal depresses the level of the pressurized surface and raises the level of the non-pressurized surface in the same fashion as a manometer. The liquid level is chosen so that the liquid seal is not lost in normal operation, but so that a small increase such as could occur from any possible mal-operation would blow out the seal and relieve the pressure in the same fashion as with commonly used oil seals.



THIS MONTH'S COVER is a close-up of the Venturi tube installation with three years of results behind it at Seeligson

FOR METERING GAS FLOW

Venturi Tube vs. Orifice Plate

*By DAN T. McDONALD**

MEASURING the flow of gas in large volumes or at low pressures can be accomplished with very satisfactory results using the Venturi tube rather than the conventional orifice plate flow meter.

More than three years' experience with this device in the Seeligson Operators' natural gasoline plant at Premont, Texas, has shown that:

Direct savings in compressor horsepower (or a greater station capacity) are realized with the Venturi tube, since it operates with a smaller permanent loss of head than does the orifice on all flow rates and diameter ratios.

Investment and installation costs may favor either the Venturi tube or the orifice installation, depending upon specific applications and the installer's construction standards.

Field accuracy of the Venturi tube installation appears to check field orifice meters with dependable accuracy and tolerance.

Mechanical service problems are the same as for orifice metering—the same type of service and technical personnel are required, recording gages identical to orifice installations are used, and charts are computed with integrators in the same manner.

Conventional methods of metering involve the measurement of a pressure differential across a known constriction in the flowing stream of gas. A fraction of this pressure differential results in a non-recoverable loss of head in the flowing stream. In most cases this loss of head must be replaced by means of mechanical compressors before the gas reaches its point of ultimate consumption.

The power required to restore the pressure loss depends upon the ratio of the absolute pressures upstream and downstream of the meter, and the rate of flow. Therefore, with a fixed rate of flow, it takes more power to restore a given pressure drop at low pressure levels than at high levels. This accentuates the savings realized with a low pressure loss at low pressures.

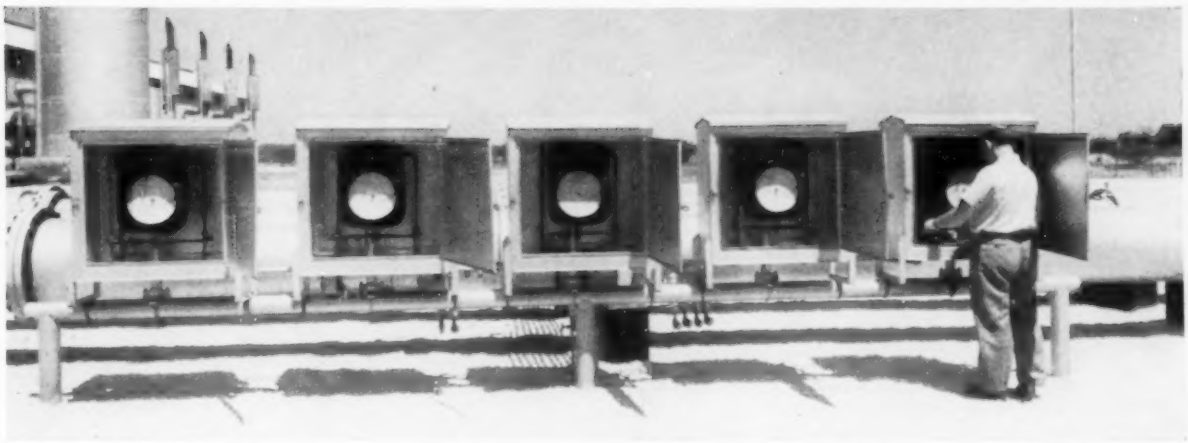
The Venturi tube is particularly suited for metering large volumes of fluid with low pressure-head losses. It is constructed with gradual tapering to and from the flow constriction, so that the fluid passing through it loses a minimum of energy due to impact and internal friction.

The natural gas industry has used the sharp-edged orifice almost exclusively for its measurement of gas. This industry has been blessed in the past with an abundance of cheap energy supply and high-pressure sources of gas. With the booming market for natural gas, both today and for the foreseeable future, and the modern conservation practices of utilizing low-pressure sources of gas to prevent its wastage to air, the industry is becoming even more "efficiency conscious" than in past years. The Venturi tube, while not a cure-all by any means, does have a good future application as a means of conserving energy in the natural gas industry.

The Seeligson plant collects, compresses, processes, and delivers to a high pressure transmission line a large quantity of casinghead natural gas produced at atmospheric pressure from crude oil wellstream separators. Five Venturi tubes are installed at this plant to meter the casinghead gas from each of five gathering lines coming from various parts of the field. The gas is metered at about 10 in. Hg vacuum at the plant intake.

Inasmuch as the use of the Venturi tube is relatively new to the natural gas industry, and because it promises to have a greater future usage, natural gas men responsible for the design and operation of gas processing and transportation facilities will be interested in some of the details of the Seeligson application. These details are briefly given in the following sections which deal with both the theoretical and practical aspects of the installation. In this discussion, the Venturi tube is compared to the orifice, because the latter has been the "standard" of the industry.

* Formerly chief process and design engineer, Natural Gas Dept., Magnolia Petroleum Co., Dallas, Texas; now vice president and general manager, Bowie Gasoline Co., Dallas, Texas.



ONE RECORDER FOR EACH VENTURI TUBE—These instruments are installed in individual houses near the tubes

Theory, Technical Considerations

The flow of fluids through any type of conduit is governed by the same fundamental laws of physics, whether the fluid be gas or liquid. This is true for pipelines, flow nozzles, jets, chokes, orifices, Venturi tubes, etc. The mathematical expression of the rate of flow, or other related factors, for gases or liquids differs primarily in the selection of empirical constants to allow for the limitations of the practical approach to ideal conditions of flow. Since this paper deals only with gas measurement, the mathematical relations will be confined to the orifice and the Venturi tube as used to measure gas flow through a pipeline. The discussion will be further limited to the practical methods of calculation in current use by the natural gas industry.

1—General Measurement Equation: The hourly rate of flow at base conditions is expressed, in the units given in the nomenclature section at the end of this paper, by the following fundamental equation:[2]

$$Q_h = 218.44\, K D_2^2 \frac{T_b}{p_b} \sqrt{\frac{1}{T_f \cdot G}} \sqrt{h_w \cdot p_f} \quad \ldots\ldots (1)$$

This equation is valid for orifices as well as for Venturi tubes. When measuring a compressible fluid, a correction factor known as "expansion factor" Y must be introduced in the equation to allow for a change in density due to changes in velocity and pressure in the flow. The hourly rate of flow is thus given by the fundamental equation:

$$Q_h = 218.44\, K\, Y\, D_2^2 \frac{T_b}{p_b} \sqrt{\frac{1}{T_f \cdot G}} \sqrt{h_w \cdot p_f} \quad \ldots\ldots (2)^*$$

It must be noted that the flow coefficient K is related to "coefficient of discharge" C by the equation:

$$K = \frac{C}{\sqrt{1-\beta^4}} \quad \ldots\ldots (3)$$

Where C = coefficient of discharge.
K = Flow coefficient, including the velocity of approach factor, which is $1/\sqrt{1-\beta^4}$

2—Evaluation of the Coefficient of Discharge: The evaluation of the coefficient of discharge, C, and the flow coefficient, K, is a matter of experimentation. Much work has been done in evaluating C for orifices and for Venturi tubes.[1, 2]

The Reynolds number is used in correlating data pertaining to the flow of fluids. Plots of the coefficient of discharge as a function of Reynolds number indicate that, for a given diameter ratio β, the coefficient of the Venturi tube is higher than that of the corresponding orifice at all Reynolds numbers commonly encountered in gas measurement.

For field application, it becomes necessary to assign a coefficient to a specific metering installation. In the case of orifices, the gas industry has compiled data from which field personnel can readily compute a value of C (or of K) for a given combination of conduit and orifice sizes.[2, 3] For Venturi tubes which are factory-built to set specifications, the value of C is still usually supplied by the manufacturer, although it may be computed by field personnel as readily as for the orifice.[1]

3—Computation of Flow: To illustrate the method of computation of flow by the orifice or the Venturi tube, the following example is presented in terms conventionally used in the natural gas industry.

Consider first an orifice with flange taps, operating under the following conditions:

Pressure base	14.65 psia.
Temperature base	60°F. (520°R.)
Flowing temperature	100°F. (560°R.)
Specific gravity (air = 1.000)	0.760
Pipe inside diameter	23.500 in.
Orifice diameter	16.000 in.
Manometer differential range	20 in. of water
Chart differential reading	15 in. of water
Static pressure at upstream pressure tap	10.0 psia.

Using Equation 2 with values of K and Y commonly accepted in the natual gas industry,[2] the hourly rate of flow at base conditions is found to be:

$$Q_h = 784{,}800 \text{ cu. ft./hr.}$$

Let us now consider the metering of the same hourly rate of flow by a Venturi tube under the same conditions in the same pipeline. Using the coefficients generally accepted for this type of flow metering device[1] we find:

a) that a Venturi tube having a throat diameter equal to the orifice diameter (16.000 in.) will register a differential pressure of only 5.54 in. of water—instead of 15 in. for the orifice.

b) that a Venturi tube designed to give the same differential pressure of 15 in. of water will have a throat diameter of only 13.052 in. ($\beta = 0.5554$), as compared with 16.000 in. ($\beta = 0.6809$) for the orifice.

This comparison therefore indicates that:

a) For the same maximum value of the differential pressure, higher rates of flow may be measured by a Venturi tube than by an orifice of equal diameter ratio.

b) If a Venturi tube designed to measure a given rate of

* For the Venturi tube, the notation ϕ is generally used instead of Y to represent the expansion factor.

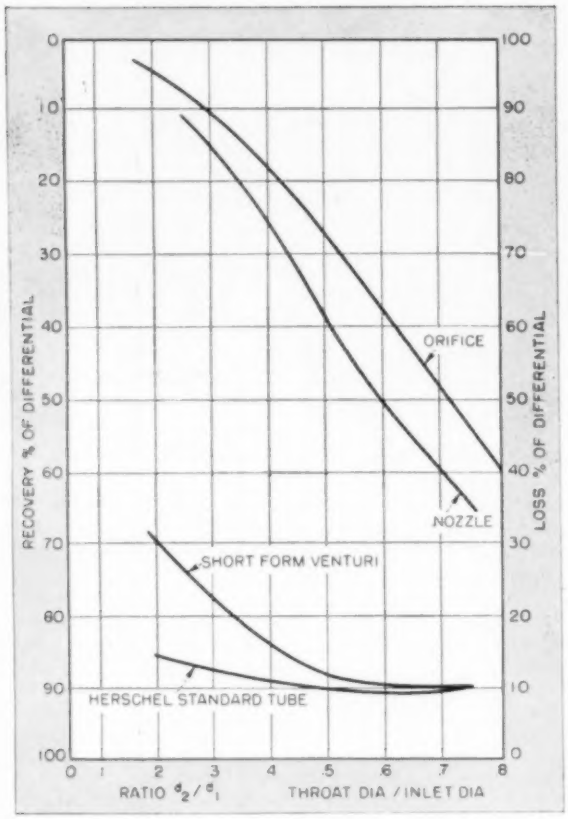


FIG. 1—Recovery characteristics of differential producers

flow, under a given differential head, has an opening ratio close to the practical limit of $\beta = 0.70$ (some Venturi tubes are built with values as high as $\beta = 0.75$), then it will not be possible to design an orifice to operate under the same conditions, since the opening ratio of that orifice would have to exceed the limit of $\beta = 0.7$.

Economic Considerations

In selecting a metering installation, economic as well as the engineering facets of the specific installation must be considered. The chief economic factors are usually initial investment and operating expense.

The investment for a given installation is partially governed by the mechanical standards of the installer. Factors such as by-passing, valving, and provisions for service and inspection greatly influence the investment cost of any metering installation. The ordinary orifice installation is usually fabricated, either in the shop or the field, of carefully selected stock line pipe. Often premium prices are paid to secure select pipe for orifice run fabrication.

The Venturi tube is a factory-built unit which is constructed to close tolerances, particularly the machined throat. As indicated in the above comparison, for a specific metering job, a smaller nominal sized Venturi tube can be used than in the case of an orifice run. For handling large capacities, the use of a single Venturi tube can often replace several parallel large orifice runs. Since orifices require longer approach sections of straight tubing than Venturi tubes, this indicates a marked advantage in favor of the latter. The investment can quite often favor the Venturi tube but the installer should always carefully evaluate his specific application.

The operating expense of either Venturi tubes or orifices is made up primarily of mechanical service, inspections and horsepower loss costs. For clean gas it is doubtful if the mechanical service and inspection expense would be different, on the average, for either the Venturi tube or the orifice. On dirty gas, or gas contaminated with liquid components, the Venturi tube should require less service and inspection expense due to its tapered smooth throat as compared to the concentric orifice, which is apt to permit accumulation of the extraneous matter.

The horsepower loss factor always favors the Venturi. The Venturi tube has a high efficiency of operation at the same capacity and run dimensions. That is, it imposes a smaller head loss, or stated another way, *the Venturi type flow permits a much higher recovery of the differential head as permanent static head.*

Loss of permanent static head is directly related to horsepower loss, which in most installations has a specific intrinsic value. For liquid measurement problems, the horsepower loss evaluation has been well presented in Thoresen's paper, "The Selection of Main Line Meters."[4] The same principles are involved in gas flow and Fig. 1, reproduced from Thoresen's paper, is directly applicable.

Fig. 1 shows the permanent loss of differential head at various diameter-ratios for orifices, nozzles, and Venturi tubes. For any proposed metering installation, the differential head imposed by the constriction to flow can be computed. Reference to Fig. 1 will then evaluate the portion of this differential head which is permanently lost. By simple engineering calculations the lost head can be converted to horsepower. The value of horsepower loss can be translated to money values for the particular installation. This horsepower loss is appreciably more for orifices than for Venturi tubes.

As a brief illustration, assume the following conditions as a basis for evaluating the relative horsepower losses due to a Venturi tube and an orifice, each metering the same gas under essentially identical conditions.

a—Conditions:

Rate of flow	647,000 cu. ft./hr.
Conduit diameter	23.500 in.
Diameter ratio (β)	.500 for Venturi tube and .6180 for orifice

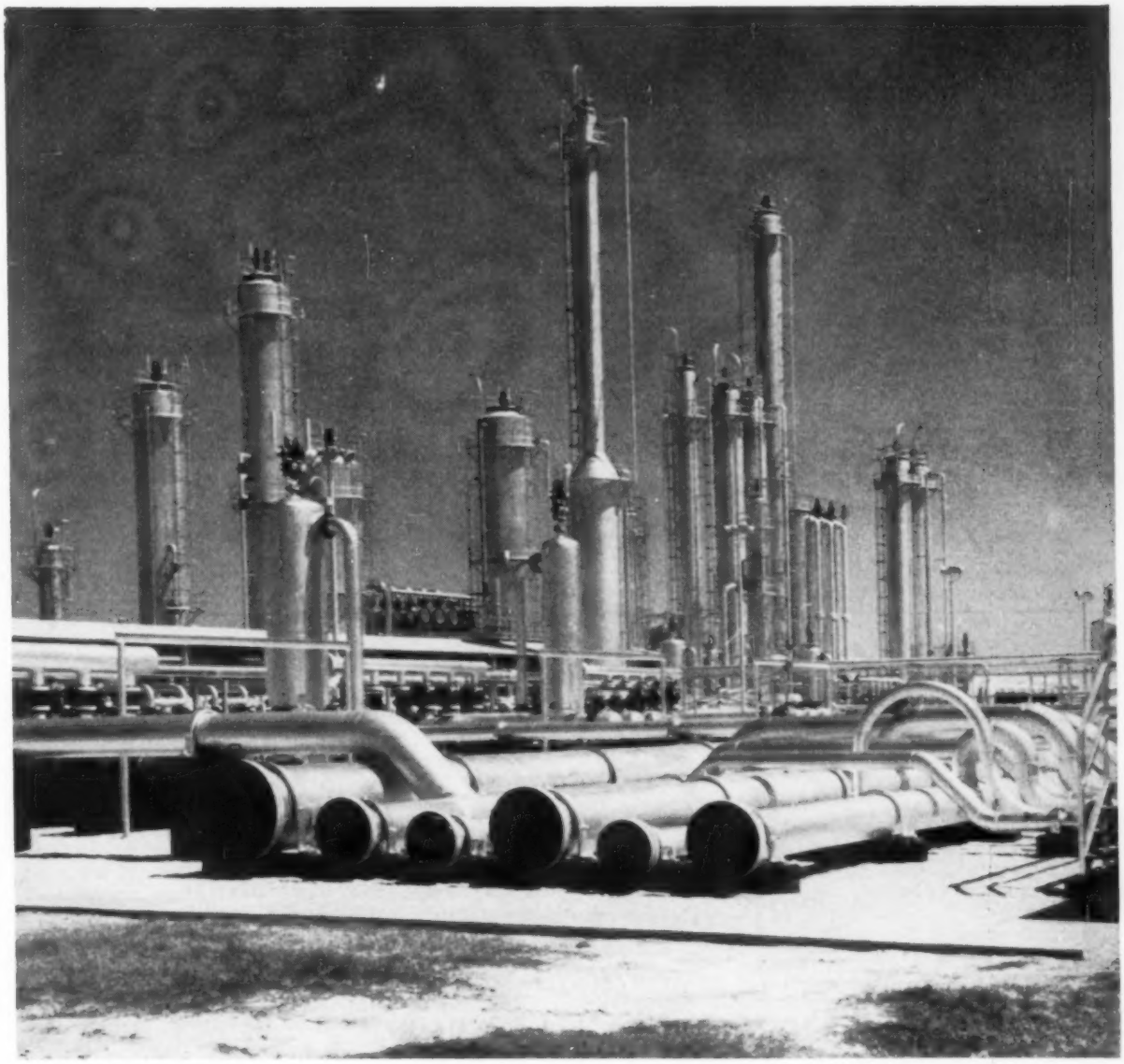
Nomenclature

Definitions assigned to the various symbols used in this paper are as follows:

D_1 = pipe diameter, in inches
D_2 = throat or orifice diameter, in inches
$\beta = D_2/D_1$ = diameter ratio
C = coefficient of discharge
K = flow coefficient, including velocity of approach factor:
or $K = C/\sqrt{1-\beta^4}$
Y = expansion factor
p = pressure, in psia.
h_w = differential head, in inches of water (at 60°F.)
T = absolute temperature, in ° Rankine
G = specific gravity (air = 1.000)
Q_b = quantity of fluid flowing at base conditions, in cu. ft./hr.
N = mols of fluid flowing per hour
k = adiabatic exponent
R = universal gas constant, in Btu/mol/°R.
W = rate of external work, in HP

Subscripts

1 = upstream condition
2 = orifice or throat condition
3 = downstream condition
f = flowing condition
b = base condition



PROCESS AREA at Seeligson, showing compressor station gas headers in foreground

Static pressure at upstream pressure tap	10.0 psia.
Flowing temperature	100°F
Specific gravity (air = 1.000)	0.760
Differential pressure	15 in. H_2O

b—Venturi Head Loss: The differential developed by the Venturi is 15 in. of water, according to the above conditions.

The permanent loss of head (from Fig. 1) is 10.00% of 15 in., or 1.5 in. of water (0.054 psi.).

c—Orifice Head Loss: The orifice opening has been calculated to give the same differential of 15 in. of water as is developed by the Venturi tube. The permanent loss of head (from Fig. 1) is 64% of 15 in., or 9.60 in. of water (0.347 psi.).

These calculations show that for the same differential, the permanent loss of head for the orifice is more than six (6) times that of the Venturi tube.

d—Horsepower Loss: The theoretical horsepower loss due to permanent loss of head across the Venturi tube and the orifice may be calculated as adiabatic work by the equation:

$$W = \frac{-kNRT_f}{k-1}\left\{\left(\frac{p_2}{p_1}\right)^{\frac{k-1}{k}} - 1\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

with

$N = 1{,}148{,}000/380 = 3{,}021$ mol/hr.
$R = 1.987$ Btu/mol/°R.
$T_f = 560$°R.
$k = 1.29$
$p_1 = 10.0$ psia.

Then:

$$W = -14{,}953{,}000\left\{\left(\frac{p_2}{10}\right)^{0.225} - 1\right\} \text{ Btu.}$$

$$= -5877\left\{\left(\frac{p_2}{10}\right)^{0.225} - 1\right\} \text{ HP}$$

For the Venturi: $p_2 = 10 - .056 = 9.944$ psia.
and $W = 7.46$ HP
For the orifice: $p_2 = 10 - 0.347 = 9.653$ psia.
and $W = 46.49$ HP

Table 1—Comparison of Measurement by Field Orifice Meters with Plant Venturi Meters at Seeligson Plant

Monthly Period	Orifice Measurement: Mscf/Month T/f = 60°F.	Orifice Measurement: Avg. Atmos. Temp., °F.	Orifice Measurement: Mscf/Month Corr. for Temp.*	Venturi Measurement: Mscf/Month (Corrected to 60°F.)	Difference: Venturi-Orifice: Metered Vol. MscF @ 60°F.	Difference: Venturi-Orifice: Percentage**
1	1,003,581	81	983,911	984,469	558	0.057
2	948,105	86	925,256	939,388	14,132	1.53
3	1,049,436	86	1,024,145	1,051,471	27,326	2.67
4	965,515	86	942,246	969,382	27,136	2.88
5	958,654	84	937,276	935,179	−2,097	−0.22
6	932,350	76	918,365	929,644	11,279	1.23
7	912,424	66	907,223	902,581	−4,642	−0.51
8	835,773	64	832,597	833,720	1,123	0.13
9	845,517	69	838,330	855,639	17,309	2.06
10	737,995	66	733,788	737,901	4,113	0.56
11	803,352	67	797,970	788,830	−9,140	−1.15
12	816,938	76	804,684	806,153	1,469	0.18
Total	10,809,640		10,645,791	10,734,357	88,566	0.83

NOTES: 1—Orifice average measuring pressure approx. 1.0 psig.; Venturi average measuring pressure approx. 8.5 in Hg. Vac.; gathering system operating at average pressure approx. 3.0 in. Hg. Vac.

2—Orifice meter gages 20 in. range, Venturi 10 in. range.

* Flowing temperature assumed to be same as average atmospheric temperature at nearest U.S. Weather Station at Falfurrias, 12 miles distant.

** Percentage differences are referred to orifice measurements, corrected for temperature.

These calculations show that for the same differential developed, the power loss for the orifice is more than six (6) times as great as that for the Venturi tube.

In many instances the opening in an orifice cannot be made as large as desired because the accuracy would not be sufficient. It is customary in gas measurement, when high accuracy is required, to limit β to 0.70. Assume the same conditions as in the previous examples, except that the rate of flow = 1,395,000 cu. ft./hr., and β for the Venturi tube equals 0.7.

The differential developed by the Venturi tube will still be 15 in. of water, the loss of head will be 1.50 in. of water = 0.054 psi., and the power loss will be 15.43 HP.

When an orifice is used under the same conditions, its opening must be limited to 16.45 in. for $\beta = 0.7$. Otherwise, accuracy will not be satisfactory. The differential developed will then be 41.65 in. of water, the loss of head will be 22.49 in. of water = 0.811 psi., and the power required to overcome the loss will be 237.82 HP, i.e., more than 15 times that of the Venturi tube.

It can be seen from this latter example* that under these conditions 222 HP can be saved by using a Venturi tube instead of an orifice. This is the horsepower actually added to the gas stream. Losses in compression and in the compressor prime mover will substantially increase the cost of pumping the gas.

Field Accuracy

The gas engineer, familiar with orifice metering through years of usage in his trade, might well say, "Theoretically the Venturi tube is sound, but what about its serviceability and accuracy in field application?" This is a difficult question to answer with unassailable proof since any gas measurement engineer knows that the reproducibility of measurement through series orifice meters of varying diameter ratios, or even identical settings, is limited. The data shown in Table 1 may partially answer the logical query set forth above.

The data in Table 1 are for Seeligson Operators' casinghead gas measurement stations and cover a 12-month period. The field measurement is accomplished by some 170 orifice meters, while the Venturi tube measurement is at the plant's five master inlet stations. The field meter did not have recording thermometers so the field volume is computed at an assumed average temperature of 60° F. and again at monthly average temperatures for the nearest U. S. Weather Station (12 mi. distant). The Venturi tubes did have a recording thermometer, so the volume computed for them is corrected to 60° F. from factual information.

Study of Table 1 will show that the Venturi tubes and orifices checked within 0.83% for the annual average for the orifice temperature assumed. Spot monthly data are +2.88% and —1.15% maximum deviations. While these data are inadequate to *prove* the accuracy of either type of measurement, it does seem fair to conclude that the Venturi tubes are doing a dependable job of measurement at Seeligson. On spot checks made at the plant during its early operation, the Venturi tube measurement more nearly checked the plant discharge measurement (orifice) than did the field measurement.

Seeligson Installation

The Seeligson Operators' plant is, to the writer's knowledge, a pioneer Venturi installation for natural gas field service. This installation normally operates under a vacuum of 10 in. Hg and meters wet field gas to the casinghead gas compressor station. A Venturi tube is set in each of five pipelines bringing gas from the various parts of the field. Each is the size of the line it is set in (four 24-in. and one 20-in.) and the throats are sized to meter a total of 70,000 Mscf/day at a metering differential of 5 in. water (permanent loss approximately 0.5 in. water).

At design conditions it is estimated that the Venturi tube measurement will save between 300 and 500 compression horsepower over orifice metering at the maximum diameter ratio of 0.70 and the same metering differential.

The recording gages at the Seeligson installation are standard Metric meters, the same as conventionally used with orifice measurement. The Venturi tubes were supplied

* Note—If one assumes the conditions indicated in the section on "Computation of Flow" above, (i.e.—23.500 in. conduit dia.; 0.6809 diameter ratio, and flow of 784,800 cu. ft./hr.) calculations show: for Venturi tube—differential head=5.54 in.; permanent head loss = 0.57 in. = 0.021 psi.; power loss = 3.37 HP. For orifice—differential head = 15 in.; permanent head loss = 8.50 in. = 0.306 psi.; power loss = 49.7 HP.

by Builders-Providence, Inc., and are the standard long (Herschel) tubes.

The Venturi tubes are serviced by plant meter men. Inspections of the throats have shown them to be unusually clean. No mechanical difficulties have been experienced in three years of operation. The recorder charts are square-root type and are read on the conventional mechanical chart integrator right along with the orifice meter charts. Correction factors are taken directly from the well-known orifice meter handbooks such as the American Meter Co. E-2 Handbook.[3] This handbook presents the A.G.A.-A.S.M.E. orifice data in a form such that they can easily be used by men in the field.

The Seeligson Plant Committee is to be credited with the engineering selection of the Venturi tubes for the Seeligson Operators' plant installation.

Acknowledgments

The writer wishes to acknowledge the assistance of Mr. U. E. Thorne, meter inspector, Magnolia Petroleum Co., who supplied the data on field performance, and Dr. Andre L. Jorissen, professor and head of the Dept. of Hydraulics and Hydraulic Engineering, Cornell University, who reviewed the theory and calculations presented in this article.

References

(1) "Fluid Meters, Their Theory and Application," ASME Research Publication, 1937.
(2) "Gas Measurement," Committee Report No. 2, America Gas Assn., 1951.
(3) "Orifice Meter Constants," Handbook E-2, American Meter Co.
(4) "The Selection of Main Line Meters," by J. C. Thoresen, *Water & Sewage Works*, in press.

Appendix—Orifice and Venturi Tube Computations

General flow equation:

$$Q = KA_2Y\sqrt{2\left(\frac{p_1 - p_2}{\rho}\right)}$$

With the units indicated in the nomenclature, hourly rate of flow, under flowing conditions Q_f is given by

$$\frac{Q_f}{3600} = K\ Y \times \frac{\pi}{4} \times \frac{D_2^2}{144}\sqrt{\frac{2 \times 62.37 \times 32.17}{12}} \times \frac{h_w}{w}$$

where ρ = lb. (mass)/ft.^{3}
w = lb. (wgt.)/ft.^{3}

$$Q_f = 359.1\ K\ Y\ D_2^2\ \frac{\sqrt{h_w}}{\rho}$$

$$\rho = 0.08073\ \frac{p_f}{14.7} \times \frac{(460+32)}{T_f} \times G$$

(density of air at 14.7 psia and 32°F. = 0.08073 lb./ft.^{3})

$$Q_f = 218.44\ K\ Y\ D_2^2\sqrt{\frac{h_w}{p_f} \times \frac{T_f}{G}}$$

At base conditions:

$$Q_h = \frac{p_f \times Q_f \times T_b}{p_b \times T_f}$$

$$Q_h = 218.44 \times K \times Y \times D_2^2\ \frac{T_b}{p_b}\sqrt{\frac{1}{T_f \times G}}\ \sqrt{h_w \times p_f}$$

(compare with Equation 13 in A.G.A. Comm. Rep. "Gas Measurement.")[2].

or:

$$Q_h = C'\sqrt{h_w \times p_f}$$

with:

$$C' = 218.44\ K \times Y \times D_2 \times \frac{T_b}{p_b}\sqrt{\frac{1}{T_f \times G}}$$

In example chosen (as described under "Computation of Flow" in the article):

$D_2 = 16.000$ in.
$T_b = 520$°R.
$p_b = 14.65$ psia.
$T_f = 560$°R.
$G = 0.76$
$C' = 376.04\ K \times Y \times D_2^2$

For the Orifice: Flange taps (see A.G.A. Com. Rep. No. 2, "Gas Measurement"[2] for equations used—17, 19, 20, 21, 23 and 30):

K_a (from Equation 17) = 0.6812
B (from Equation 21) = 109.3
E (from Equation 20) = 6096
K_o (from Equation 19) = 0.6773
R_d = 1,840,000 (for an estimated Q of 780,000 cu.ft./hr. and a value of $\nu = \mu/\rho = 0.0000069/0.08073 = 0.0001125$ sq.ft./sec.
K (from Equation 23) = 0.6795
Differential pressure = 15 in. H_2O = 0.542 psi.
$p_2 = 10.000 - 0.542 = 9.458$ psia.
$x = \frac{p_1 - p_2}{p_1} = \frac{0.542}{10} = 0.0542$
Y (from Equation 30) = 0.9796
$C' = 64{,}080$
$Q_h = C'\sqrt{h_w \times p_f} = 64{,}080\ \sqrt{15 \times 10} = 784{,}800$ cu. ft./hr.

For the Venturi tube:

Same T_b, p_b, T_f, G, Q_h
A. Assume same D_2, $p_f = p_1$. Compute h_w
$K = C/\sqrt{1-\beta^4}$
$C = 0.985$ (from Fig. 64 and Equation 261 in ASME Research Publ., "Fluid Meters, Their Theory and Application.")[1]
$K = 1.1116$
By trial and error: $h_w = 5.54$ in. $H_2O = 0.2001$ psi.
$r = \frac{p_2}{p} = \frac{10 - 0.2001}{10} = 0.98$
$Y = 0.985$ (from Fig. 57 in ASME Res. Pub., "Fluid Meters, Their Theory and Application.")[1]
Differential pressure for Venturi = 5.54 in. H_2O instead of 15 in. H_2O for orifice under same conditions.
B. Assume same h_w (15 in. H_2O), $p_f = p_1$ (10.0 psia). Compute D_2.
By trial and error: $D_2 = 13.052$ in.
$\beta = 0.5554$
$C = 0.986$ (from Fig. 64 and Equation 261 in ASME Res. Pub., "Fluid Meters, Their Theory and Application.")[1]
$K = 1.037$
$p_1 = 10.000$ psia.
$p_2 = 9.458$ psia.
$r = \frac{p_2}{p_1} = 0.946$
$Y = 0.965$ (from Fig. 57 in ASME Res. Publ.)[1]

Comparison is as follows:

Orifice	*Venturi*
$D_2 = 16.000$ in.	$D_2 = 13.052$ in.
$\beta = 0.6809$	$\beta = 0.5554$

FIGHT CORROSION!

Five Steps to Lower Corrosion Costs

1. Study high maintenance charges—corrosion's "signals"
2. Take a broad basic approach to solving specific problems
3. Check cases and diagnose them for evidence of corrosion
4. Turn to plant case histories for help on other problems
5. Estimate monetary losses in individual repair projects

By V. B. GUTHRIE

THE five principles enumerated above are basic in any successful program to cut the high corrosion costs confronting the petroleum processing industries today, according to the experience of Shell Oil Co.

Importance of these principles was recognized when the company, in 1952, reorganized its methods for dealing with the deterioration of materials in all its fields of activities and set up the present Management Engineering Council Corrosion Committee. Greater details on this reorganized program are given on the next pages.

Study Maintenance Costs

The usual starting point for Shell in its program is an intensive study of maintenance costs in the individual plant. These costs are not compared with the so-called "normal" maintenance charges, either for that or for other plants. Rather, they are examined in the light of whether they may be excessive when compared to the original cost of the equipment and the work it performs. Costs are studied in the light of previous maintenance charges on that equipment or processing unit and whether they come at periodic peaks—perhaps from a shutdown. The causes of such peaks are then analyzed.

Regardless of the proportion of maintenance costs that may be arbitrarily assigned to corrosion, if the maintenance is found to be unduly high, corrosion will be found to be the cause, in many cases in the company's experience. Here then is where the work on remedial measures will start. High maintenance costs are looked upon as the "red flag" that signifies danger from materials deterioration.

In one instance, a Shell plant was confronted with peak maintenance costs at regular intervals, caused by the shutdown of a thermal cracking unit to replace the brickwork. Failure of burners and burner boxes was found to be the cause of the trouble. The problem was solved by replacing them with 28-chrome-12-nickel stainless steel instead of the previous procedure of using cast iron. In this instance the cost of alloy was inconsequential compared with that of brickwork repair.

Take a Broad Approach

In Shell's experience, a broad approach to a specific problem in corrosion is considered essential to a basic solution for the difficulty. In the processing technique, a corrosive substance must originate someplace and it may pass through several units and their pumps, as well as connecting lines and heat exchangers.

Repairing the damage to any particular tank, pump, or vessel provides only a temporary remedy. Broad study of the specific problem, on the other hand, may lead to a basic cause. This, if remedied, can then provide relief for perhaps several pieces of equipment all at one time.

In one case in a Shell operation, a plant was having serious corrosion in distillation equipment, the feed to which was treated with caustic soda. The conditions under which the treatment was carried out made neutralization difficult, and periodically the stripper column tops would become acidic with material being carried through. The top of the column, vapor line, accumulator pump, piping, and valves handling the condensate were being attacked. In each instance, these could have been treated as separate corrosion problems and costly corrosion-resistant material installed.

But, by determining where the contaminant originated, the corrosion protection work was concentrated on the soda neutralization operation. The method of treatment was revised so that acidic material was not being carried into the feed stream of the unit and several specific corrosion problems were ended.

Diagnose for Trouble

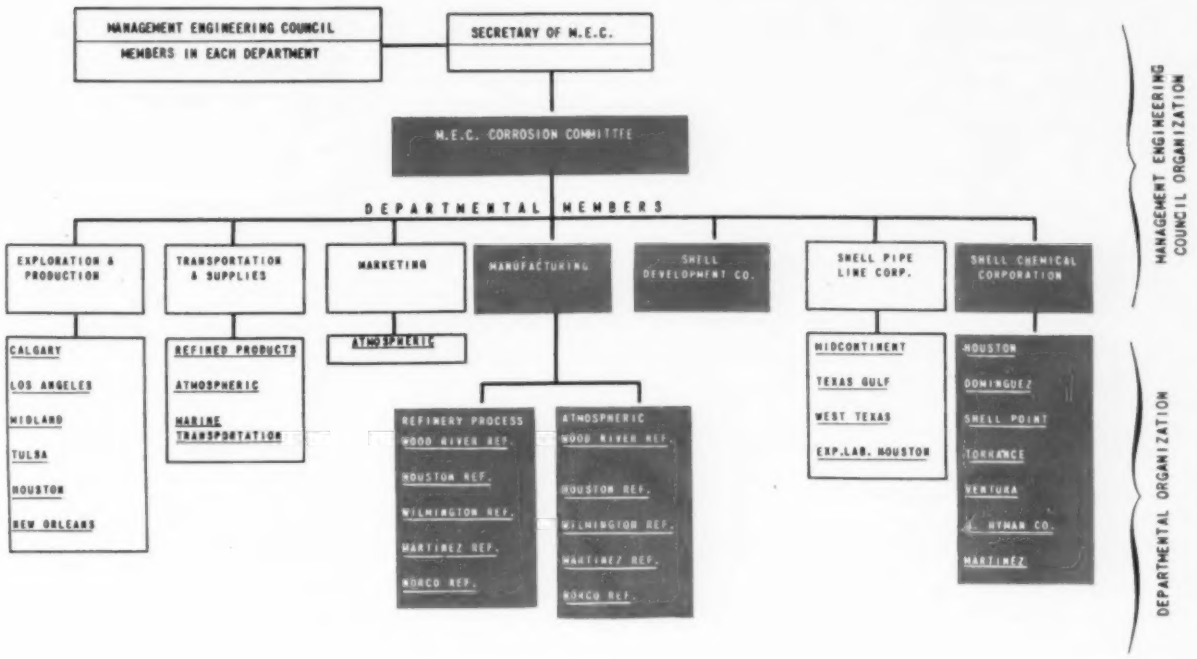
Emphasis is also given in Shell's program to insuring a correct diagnosis of the cause of damage to a particular piece of equipment or a processing unit. This stems from earlier days when it was accepted as routine by the operators that equipment had to be replaced or repaired at intervals. The cause was simply "it's just wearing out."

Today, the company insists that the cause of the damage be determined. Scale from the metal is examined to see whether it is a product of corrosion. The metal itself may be tested to determine if it was that which had been specified for the equipment. Samples of materials passing through the equipment are analyzed for corrosive characteristics. Other means are also used as required to make sure that the diagnosis of damage detects evidence of corrosion. The corrosion engineers have adequate tools and equipment to study and diagnose corrosion and material failures.

Study Case Histories

In the Shell program, case histories are recognized as important in determining the treatment needed for current problems. Each plant sets up its own system for filing records so that experience data can be pulled out promptly. In each plant also, active corrosion cases carry through their history a project number for easier reference to the applicable data.

ORGANIZATION CHART OF THE MANAGEMENT ENGINEERING COUNCIL CORROSION COMMITTEE



For wider usefulness throughout the company also, the reports on active projects at all plants are carried on uniform report forms. This form shows project number and title, location of the process unit, and description of the equipment involved. Then follows a discussion of the current status of the problem, remedies applied, and other pertinent data. Copies of the reports from individual plants are sent to the headquarters of the Corrosion Committee in Shell's New York offices.

Following study, they are put together in the form of an annual report. Similar problems coming from various plants are summarized; such as, for example, cathodic protection of the outside of tank bottoms, corrosion-resistant liners in vessels, hydrogen attack, sulfuric acid corrosion, etc. The annual reports are then supplied to all plants and also to members of the company's management engineering group.

In addition to this formal exchange of data on corrosion protection work in company plants, the head of the group handling the program in each individual plant is encouraged to report informally to the chairman of the company-wide corrosion committee on matters that might be of value to other plants, and these reports are also passed along to others. The general corrosion committee holds an annual meeting where further discussion is held on all current problems.

Estimate Repair Costs

Shell Oil Co. officials recognize that damage and loss of equipment through deterioration of materials is a high cost factor in the operation of their properties. They do not attempt to set up overall costs for corrosion losses or other deterioration of materials, not even by individual plants.

However, in all individual maintenance cases the company does ask for an evaluation of the monetary savings where a remedy has been successful. Where previous lost production through the shutdown of a unit or a piece of equipment has been avoided, an effort is made to evaluate the savings made by uninterrupted operation.

Maintenance materials and labor costs which are avoided through solving a corrosion problem are included in the savings figures. The cost of inhibitors or other protective measures are debits, as are allocations of capital costs where long-life vessel linings or similar equipment are installed.

The Corrosion Committee

The accompanying chart shows the organization of the Corrosion Committee of the Management Engineering Council of Shell Oil Co. (which is actually only one of several specialized committees reporting to the Council).

The committee was set up in 1952 and replaces a group of committees within the company, each of which had been concerned with a single field of corrosion. The MEC is a co-ordinating group within Shell management that collects and passes along information important to the management level.

The manager of the Manufacturing Engineering Dept., at New York, is chairman of MEC. There are members from each of the seven segments of the company organization: Exploration & Production, Transportation & Supplies, Marketing, Manufacturing, Shell Development Co. (research), Shell Pipe Line Corp., and Shell Chemical Corp. (petrochemicals).

The MEC corrosion Committee also has a member from each company department. Within each department, the corrosion protection work is further organized with an individual in charge at each plant, in each district, or other phase of activity.

The manufacturing department has in each refinery a head of corrosion protection in processing and also a head for protection from atmospheric corrosion (paints and coatings). Through the office of the chairman of the Corrosion Committee and the secretary of MEC (both in New York), reports of special activities in corrosion protection work that are of company significance are channeled to members of MEC. This group also receives a summary report of the annual meeting of the Corrosion Committee and it passes on recommendations from that Committee for changes in procedures in the company's corrosion work and allied fields.

Fundamentally, the new program gives more judgment and authority to the individuals handling corrosion work in each plant, while at the same time it functions to keep management fully informed on the progress being made in all departments in reducing losses.

Selection of Men Important

In the reorganization, much attention was given to the selection of men in the refineries or other points of attack who were to head up the work of mitigating losses from the deterioration of materials. At each refinery or gasoline plant, one man is in charge of corrosion problems. In large plants he may call on experienced men who work with him on problems of protection and repair of damaged equipment. In small plants he may handle the work alone and also have other duties. In every case, however, the individual selected has the responsibility for the progress in corrosion work at his plant.

Professional training in engineering, chemistry, or metallurgy is one requisite for the selection of this man, according to the interim chairman of the MEC's Corrosion Committee. However, the man is one who also has had experience in various plant activities. Particularly, he must be one who is interested and curious in what is going on. A man of this type, it has been found, in most cases is more interested in tracing down the causes of corrosion and trying to remedy them, than is the man whose past activities have been confined more narrowly to one operation. The latter is more inclined only to repair the damage in a specific instance, rather than to take the wider approach.

Almost every plant has men who have a general interest in pumps, protective coatings, materials, instruments, maintenance, etc., and whose work takes them all over the plant and in contact with operators and maintenance men.

Men of this type—if they show an interest in what happens to materials—are frequently found good at heading up the plant corrosion protection program. They are also aware of the importance of refining operations and of the part they play in keeping the plants on stream.

To the extent to which these men are not satisfied with things as they are, they will turn to mechanical means for improving corrosion protection—such as the use of heavier metals or alloys or coatings. They will use chemical analyses of process streams and metal deposits for evidence of the nature of the corrosive attack. They are the type of men who can use and interpret a chemical analysis from the laboratory and integrate this with the corrosive process which may be occurring in high temperature or high pressure process equipment.

Where and How Does Corrosion Attack?

Many are the fields in refineries for attack by corrosion of metals principally, and other types of materials deterioration, reports a study directed by the Committee on Refining Equipment of the Refining Division, American Petroleum Institute.

Here is the API group's listing of the fields of metal deterioration in refineries:

1—At Temperatures Through the Condensation Range

(A) Condensation Corrosion
- 1—Atmospheric corrosion (tanks, stacks, steelwork)
- 2—Hydrogen blistering and embrittlement (piping, process equipment)
- 3—Corrosion from condensation in insulation (insulated vessels and lines in low temperature service)
- 4—Stack and heat exchanger corrosion

(B) Stress Corrosion
- 1—Embrittlement in caustic handling equipment (sour caustic solutions at low temperatures)
- 2—Caustic embrittlement in boiler corrosion
- 3—Sulfide embrittlement (piping and process equipment)
- 4—Chloride embrittlement of stainless steels (fractionation column linings, pump impellers)
- 5—Cracking of brass condenser tubes (cooling tower hardware, brass bolts)

(C) Chemical Corrosion
- 1—Acid and acid sludge corrosion (alkylation units, lube oil acid treating plants)
- 2—Naphthenic acid corrosion (hot lines in distillation vapor lines)
- 3—Corrosion in Girbotol units (condensers, reboilers, etc.)
- 4—Selective corrosion of welds (most welded vessels and equipment)

(D) Aqueous corrosion
- 1—Condenser and cooling water corrosion (condenser pumps, piping, cooling tower hardware)
- 2—Cooling tower deterioration due to corrosion, fungus attack and delignification
- 3—Sea water corrosion (piling, ships, barges)
- 4—Cavitation attacks (cooling water systems, ships)
- 5—Impingement attack (cooling water systems, condensate accumulators, water systems, steam turbines)

2—At Temperatures Above Aqueous Range

(A) Hydrogen attack
- 1—Embrittlement
- 2—Decarburization (in both cases principally hydrogenation and dehydrogenation plant equipment)

(B) Hydrogen sulfide attack
- 1—Crude oil corrosion (tanks, pumps, lines)
- 2—Vapor phase corrosion (tanks and upper portions of fractionating equipment)

(C) Attack by hydrocarbons-carburization (furnaces)

(D) Oxidation (furnaces and high temperature equipment)
- 1—Creep
- 2—Stress-rupture
- 3—General scaling
- 4—Alternate oxidation and reduction
- 5—Catastrophic oxidation-vanadium compounds etc.
- 6—Attack by elemental sulfur

(E) Nitriding in service and accompanying embrittlement (condensers, vapor lines at low temperatures)

(F) Thermal fatigue and thermal shock (high temperature equipment)

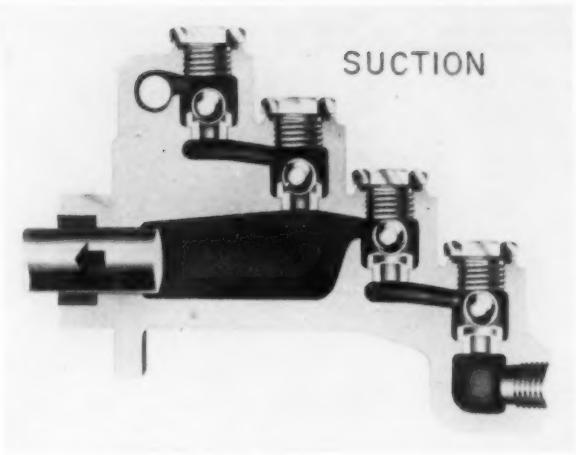
(G) Structural Instability—Carbide Spheroidization, Graphitization, Temper embrittlement, Intergranular Corrosion of Stainless Steels, 885°F. Embrittlement of Straight Chromium Stainless Steels, Sigma Phase Embrittlement of Stainless Steels (high temp. reactors, piping)

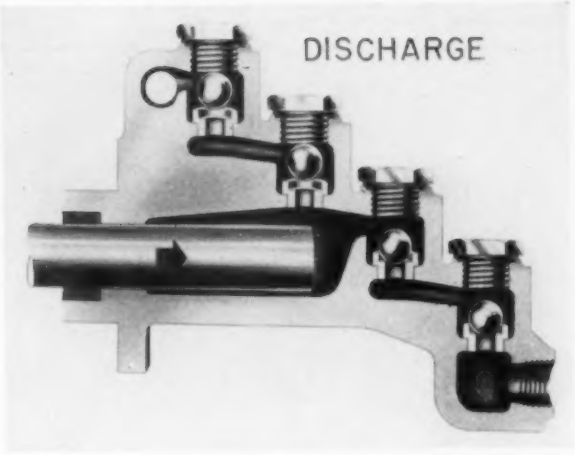
How to Save $96,500

A LARGE refinery using large amounts of sulfuric acid in treating processes and also manufacturing the acid and reclaiming it from sludges made a study of the yearly maintenance cost for valves in acid handling service. It was learned the yearly maintenance cost was $123,000. An investigation which led to the adoption of a more corrosion resistant valve resulted in an estimated yearly saving of $96,500.

A similar study applied to reciprocating pumps in sulfuric and light distillate service revealed a yearly maintenance cost of $57,600. Use of more corrosion resistant materials has reduced this cost by $49,700.

This same refinery has in the past spent about $560,000 a year for labor and materials to paint steel structures exposed to the atmosphere. Improved paints and painting practice has brought about $60,000 annual savings in painting maintenance.





HOW THE PUMP WORKS—As plunger moves out of chamber on suction stroke, intake ball valves open: as plunger moves back in, discharge valves open. Volume is controlled by varying plunger diameter, length of stroke, and rate of stroking

Controlled Volume Pumps

What they are, how they work, and how you can use them as "instruments"

By JOHN PROCOPI
Milton Roy Co.

THE word "pea" is usually associated with "pod." That the two go together is a well-known fact. A similar relation exists between low-capacity flow control problems and controlled volume pumps. They, too, go together.

The scarcity of literature on this relatively new process control equipment is responsible, probably more than any other single factor, for the limited association between low-capacity flow control problems and their obvious solution.

Another contributing factor stems from the early usage of these pumps for water treating. As a result, many engineers still erroneously regard controlled volume pumps as "water treating" devices only.

Finally, the term "pump" is, in a sense, a misnomer, since these units are more than "mechanical devices to circulate or transfer liquids." They are flow control instruments.

What They Are—Controlled volume pumps are reciprocating plunger, positive-displacement type pumps designed to deliver accurately a metered quantity of liquid, or slurry, to a point of application.

Basically, these pumps consist of a drive unit, a plunger, and a specifically-designed displacement chamber or liquid end, in which the plunger reciprocates. (See illustrations above.)

Properly designed, the displacement chamber delivers a controlled volume of liquid with each plunger stroke. On suction stroke (see photo at left), the outlet ball-checks are seated, preventing back-flow. The partial vacuum created by the suction stroke permits the inlet ball-checks to rise, liquid flows into, and fills, the displacement chamber.

On discharge (photo at right), as the plunger moves forward it exerts pressure on the liquid, seating the inlet ball-checks. The outlet checks are pushed off their seats by the displaced liquid as the plunger moves to the extreme front of the liquid end.

The "dimensions" of the displaced volume of liquid are determined by the diameter of the plunger and the length of the stroke. Obviously, a larger diameter plunger delivers a larger volume of liquid for the same stroke length. Similarly, a long stroke length delivers a larger quantity of liquid than a short stroke length. This relation between capacity and stroke length is linear. Finally, for any prescribed plunger diameter and stroke length, the volume of fluid delivered over any given period of time is in direct proportion to the stroking speed of the pump. Accuracy of metering is within 1%.

How They Work—The volume of fluid delivered, or the capacity, varies with the diameter of the plunger, the length of plunger stroke and the rate of stroking. (Discharge pressure against which these pumps operate has little effect on pump capacity, except at extremely high pressures when compressibility of the liquid must be considered.)

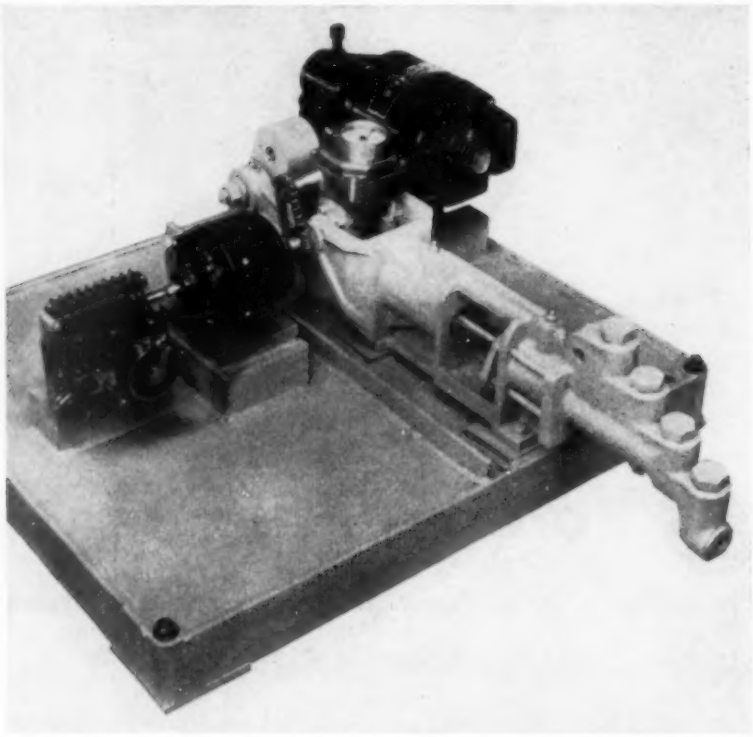
Controlled volume pumps are designed and manufactured with a variety of controls over these three variables which determine pump capacity.

Manual Adjustment of Stroke Length—In its simplest form, a controlled volume pump is driven by a constant speed motor, although air-motors are also widely used. However, the discussion here will be confined to the motor-driven type pumps.

In this constant-speed motor-driven pump, stroke length can be adjusted by a screw to give variations in capacity of the pump. This adjustment, made while the pump is not operating, alters the position of the trunnion in the slot of the drive wheel, thereby increasing or decreasing the length of the stroke.

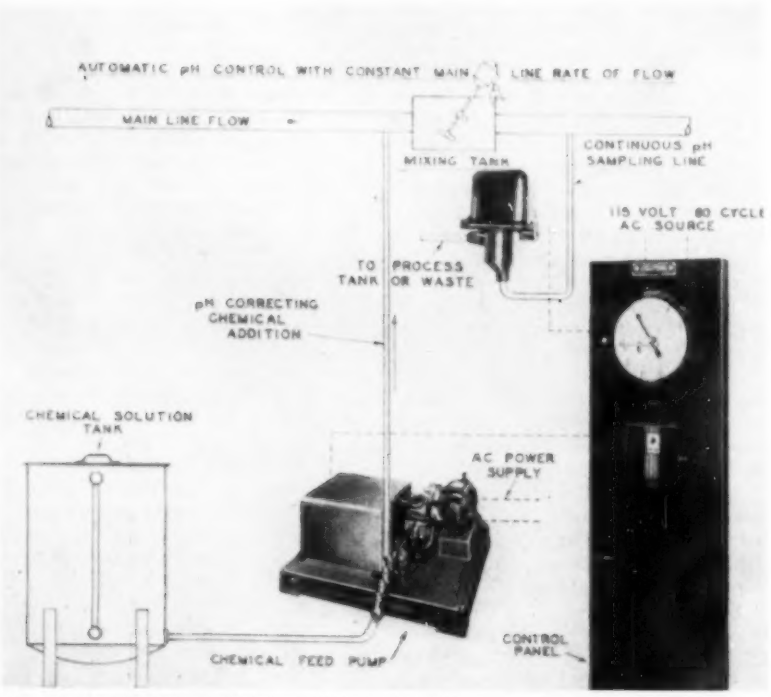
If the nature of the installation is such that any adjustment must be made while the pump is operating, a manual dial adjustment of stroke length is provided. This adjustment is made by a hand wheel operating over a chain through a gear train in the rocker box, effecting proper control of stroke length.

There is a fixed throw from the low-speed shaft of the motor gear drive to the rocker box and a variable throw



AUTOMATIC STROKE ADJUSTMENT in a controlled volume pump is obtained by a mechanism actuated by a small reversing motor

AIR-OPERATED POSITIONER can be used to regulate pump rate


AUTOMATIC pH CONTROL WITH CONSTANT MAIN LINE RATE OF FLOW
MAIN LINE FLOW
MIXING TANK
CONTINUOUS pH SAMPLING LINE
115 VOLT 60 CYCLE AC SOURCE
TO PROCESS TANK OR WASTE
pH CORRECTING CHEMICAL ADDITION
CHEMICAL SOLUTION TANK
AC POWER SUPPLY
CHEMICAL FEED PUMP
CONTROL PANEL

HOW pH CONTROL IS OBTAINED with constant flow rate in main line: pH meter regulates length of stroke on chemical feed pump

to the cross-head by means of the positioning of the connecting rod adjusted by the lead screw. A vernier dial indicates stroke length to within 1/200th of full stroke. A change in capacity down to 0.50% may be indicated by means of this adjustment.

Automatic adjustment of stroke length is also available in motor-driven pumps. The adjusting mechanism is activated by a small reversing motor (for driving the chain), limit switches, and a control potentiometer mounted in the pump base. The potentiometer is geared to the shaft of the reversing motor.

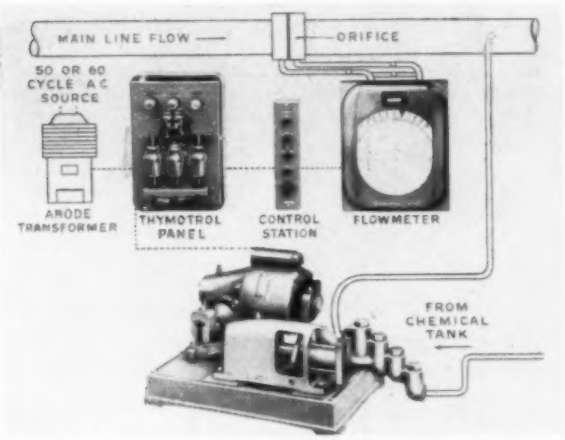
This type of pump is used as a final control element for control of a process variable such as pH. In an installation of this type, for example, a bridge circuit pH controller is used to measure the process variable. The motorized-stroke-adjustment pump regulates the flow of control agent to the process.

In operation, any deviation from the process set point results in an automatic adjustment in the stroke length of the pump to increase or decrease the flow of control agent, as needed.

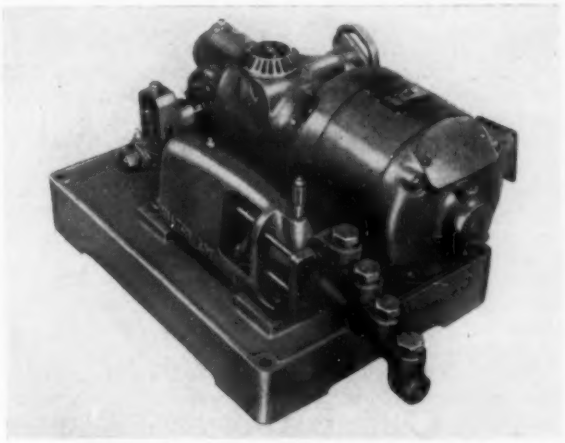
In this particular pH installation, if the main line flow varies widely, a flow controller is used in addition to the pH controller, and one pump acts as the final control element for both variables. The stroke length of the pump is automatically adjusted, in accordance with pH variations, by means of the motorized stroke adjustment.

In addition, a General Electric "Thymotrol" unit is used to regulate the speed of the pump in proportion to flow rate change, as described below.

Manual Adjustment of Stroking Speed—Since the capacity of a controlled volume pump is directly pro-



AUTOMATIC ADJUSTMENT OF STROKE SPEED as used in a proportioning pump feed system



MECHANICAL ADJUSTMENT OF STROKE SPEED plus a screw adjustment of stroke length is provided in this design

portional to the speed of operation, a positive control of speed results in direct control of the exact volume delivered by the pump. Any one of several speed changing mechanisms can be used for this purpose.

In one type of device the motor is combined with a mechanically adjustable speed changing mechanism. With it, the pump plunger stroking speed may be infinitely varied, while the pump is operating or at rest, over speed ranges of 3 to 1, 6 to 1, or 8 to 1 and, in some frames, ranges of 12 to 1 and 15 to 1. The regulating unit known as the "Speedranger" consists essentially of a set of two driver cones and two driven cones with a metal ring transmitting power from the driver to the driven cones. By changing the relative position of the ring and cones, variable speed is obtained.

By combining stroke length adjustment, previously described, with this plunger stroke speed adjustment, it is possible—for example—by using a unit with a 15 to 1 range, to secure accurate delivery over a total capacity range of 150 to 1.

In operation, output speed is increased or decreased by the turn of a hand wheel. At any setting, the speed remains practically constant, with changes in voltage or load having minor effect.

Automatic Adjustment of Stroking Speed—Positive automatic speed regulation can be effected by an electronic system employing "Thymotrol," as developed by the General Electric Co.

Alternating current, the source of power, is rectified by the "Thymotrol" for operation of a compound-wound direct-current motor. The speed is regulated with a normal range of 20 to 1, accurately controlled and directly proportional to the setting of a potentiometer in the "Thymotrol" circuit.

Plunger speed will not vary more than $\pm 1\%$ with voltage variation of $\pm 5\%$. At a given potentiometer setting, plunger speed is automatically held constant irrespective of load changes.

Motor speed and pump delivery may be regulated either manually by a 10,000-ohm potentiometer at the control station, or by a potentiometer mounted in a meter, the system being controlled automatically by any metered variable.

Where a pneumatic controller is used, automatic control of stroking speed is effected by using a variable speed mechanism mounted on the controlled volume pump. The 3-15 psi. controlled air signal from the controller varies the stroking speed of the pump to increase or decrease the amount of control agent, as needed.

Controlled volume pumps are widely applied throughout the petroleum industry. The extreme flexibility of these metering units provides the one simple solution to many flow problems, including (1) metering and pumping of predetermined small quantities of chemicals and slurries, (2) accurate ratioing of a number of chemical streams, and (3) precise automatic control of a process variable such as pH, where controlled volume pumps are used as final control elements.

Typical applications of controlled volume pumps in the refinery industry, in general, include the pumping of distillates, solvents, liquified petroleum gases, tars and asphalts, petrolatum, acids and acid sludges.

Pilot plant operations, combining in a single unit a ratio control on liquid transfer medium against any desired pressure, is a common application.

Meet the Author

John Procopi interrupted his college career to serve four years with the United States Armed Forces in World War II. He then returned to Columbia University where he received a B.S. in 1945. His early working career as a research chemist was devoted to the study of high polymers.

This was followed by a four-year period with Minneapolis-Honeywell Regulator Co., Brown Instruments Division, during which time Mr. Procopi wrote a number of papers for technical magazines on process instrumentation. He authored "Automatic Process Systems Require Careful Selection of Control Valves," which ran in this magazine in June, 1950, p. 621.

Currently, Mr. Procopi is manager of the market development department, Milton Roy Co., Philadelphia, manufacturers of controlled volume pumps and automatic chemical feed systems.

Three Jobs for Controlled Volume Pumps

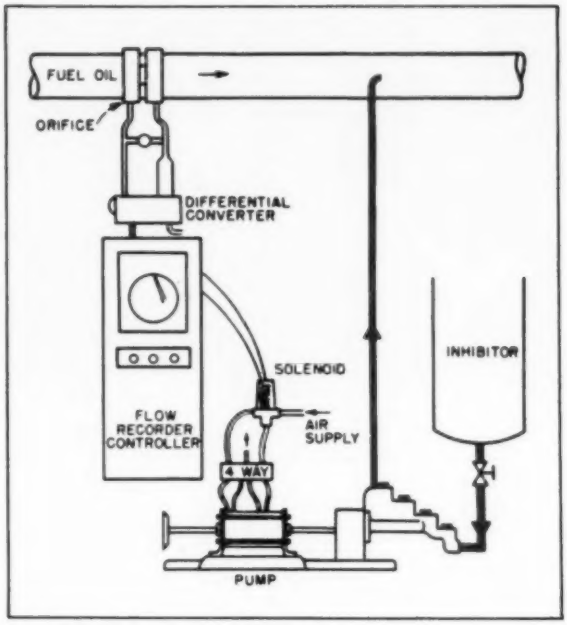
1—FUEL OIL TREATING . . . At one Eastern refinery, a proportional feed system controls the rate of addition of polymerization inhibitor to fuel oil prior to its distribution.

Flow of fuel oil is measured by a pneumatic differential pressure device which transmits an air signal, in proportion to the rate of flow, to a flow controller. This controller is equipped with a special electronic impulser which emits electric impulses (in direct ratio to the flow) to an explosion-proof, 4-way, solenoid-operated, air-pilot valve.

This pilot valve alternately admits air to either side of a double-acting pneumatic cylinder, thereby pacing the controlled volume pump. The system meters an amount of inhibitor in proportion to the rate of flow of the fuel oil.

This combination of a pneumatic flow transmitter and an air-operated controlled volume pump offers many advantages. First, it is entirely explosion-proof. The simplicity and ruggedness of the system minimizes shutdown and maintenance time. In addition, the high degree of repetitive accuracy of the pump effects efficient and economical use of the additive, with resultant dollar savings.

The flexibility of the system permits its use with any grade of oil. Whenever a change in the ratio of inhibitor addition is necessary, it can be done quickly and accurately while the system is operating by adjustment of the plunger stroke length.



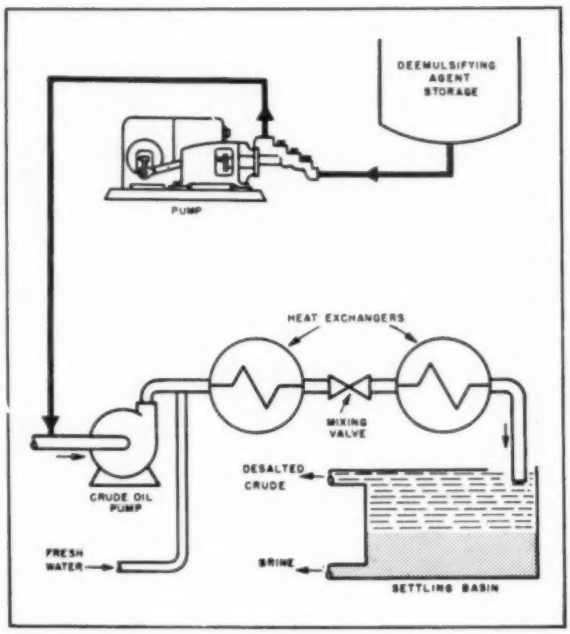
2—CRUDE DESALTING . . . In the separation of brine from crude oil, controlled volume pumps control the flow of emulsion breaking compounds into the oil-salt-water emulsion.

If there is sufficient water in the oil, no additional make-up water is necessary. However, in many cases, fresh water is added to the oil together with the emulsion-breaking compound. From this point on, the process is a solvent-extraction operation.

The mixed stream flows through a battery of heat exchangers and mixers, and finally to a settling basin where two immiscible layers are formed. The salt solution is pumped from the bottom of the basin, while the oil is removed from the top in a comparatively salt-free condition.

A controlled volume pump of simplex construction, with an explosion-proof motor is ideally suited for this application. It controls and pumps against the discharge pressure in the oil line, without the need of additional equipment.

In addition, the extremely small amounts of additives required to effect proper control are well within the range of capacities of the controlled volume pump. Finally, the high cost of emulsion-breaking compounds dictates the use of a control means which insures optimum conditions. In this application, the pumps will meter the optimum concentration within an accuracy of ±1%.



3—SAMPLING . . . It is common practice in refineries to complete distillation analyses on samples of crude oils prior to further processing. In a large Eastern refinery, as the crude is transferred from tanker to storage, a 5-gal. sample is extracted from each tanker load for analyses.

An orifice-type flowmeter controller is used on the crude line, with a control signal from the instrument controller being used to actuate a controlled volume pump. The pump withdraws the sample in proportion to rate of flow of crude.

Controlled volume pumps have also been used to sample ethylene. At one Southwestern plant, steel sampling bottles filled with water are connected into the ethylene pipeline. The outlet from these bottles is piped to the suction of a controlled volume pump.

The stroke of the pump is so adjusted that in a 24-hr. period the pump discharges approximately 2/3 of the water originally contained in the sampling bottle, thus leaving a good cross-section sample of ethylene in the bottle.

The first line of reducers is still the foremost line

TF

Old timers will recall the day—more than 20 years ago—when Taylor Forge announced the first comprehensive line of butt-welding fittings.

Before the WeldELL line was introduced, the only available welding fittings were elbows. But in the WeldELL line came all the fittings needed to do a complete and workmanlike job of pipe welding . . . the tees, reducers, caps, stub ends, and welding flanges.

To produce all of these types of fittings in seamless forged steel was a giant undertaking—and still is. A good example of this is the line of reducers. Today there are 175 reductions in standard weight reducers alone—and this can be multiplied by all the weights and materials in which Taylor Forge reducers are available.

The first line is still the foremost line—the engineered line, the full value line. For up-to-the-minute facts about the WeldELL line, see your Taylor Forge Distributor.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS
General Offices & Works • Chicago 90 • P. O. Box 485
Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

GLOBE

specialization gives you
"Tops in Quality"

ALLOY STEEL TUBES

SEAMLESS — MECHANICAL — PRESSURE — CORROSION RESISTANT

TYPICAL ANALYSES:

Carbon	5 Chrome ½ Moly
Carbon ½ Moly	7 Chrome ½ Moly
½ Chrome ½ Moly	8 Chrome ½ Moly
1 Chrome ½ Moly	8 Chrome 1 Moly
1¼ Chrome ½ Moly	9 Chrome 1 Moly
2 Chrome ½ Moly	3% Nickel 7% Nickel
2¼ Chrome 1 Moly	5% Nickel 9% Nickel

AISI Types: 304-321-347-316-309-310-405-410-430-443-446

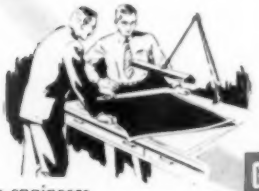
Analyses to meet conditions where heat, corrosion, pressure and structural strength are involved.

SIZE RANGE — WALL THICKNESS:

½ to 6 inches O.D. — wall thickness .035 to 1.000 inch.

TYPICAL APPLICATIONS:

Pressure tubes — Superheater tubes — Condenser tubes — Still tubes — Evaporator tubes — Barrel tubes — Oil-well Pump Barrels — Mechanical tubes — Aircraft tubes — Propeller tubes — Rollers for Transmission Chains.

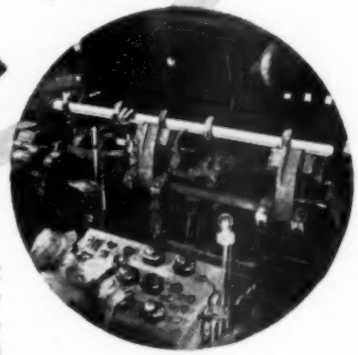


Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — to cut costs.

TO BE SURE . . . SPECIFY GLOBE

GLOBE TUBES

The heating, piercing, rolling of seamless tubes is controlled at every step for uniformity, close tolerance.



WHEN you specify Globe, you get uniform high quality alloy steel tubes, the product of highly developed production facilities and specialized quality controls and methods. All Globe tubes are thoroughly inspected and closely held within tolerance specifications. Write for the Globe general catalog.

GLOBE STEEL TUBES CO. Milwaukee 46, Wisconsin

Chicago • Cleveland • Philadelphia • St. Louis • New York
Detroit • Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

PETROLEUM PROCESSING

JANUARY 1954

Petrochemical Processing Section

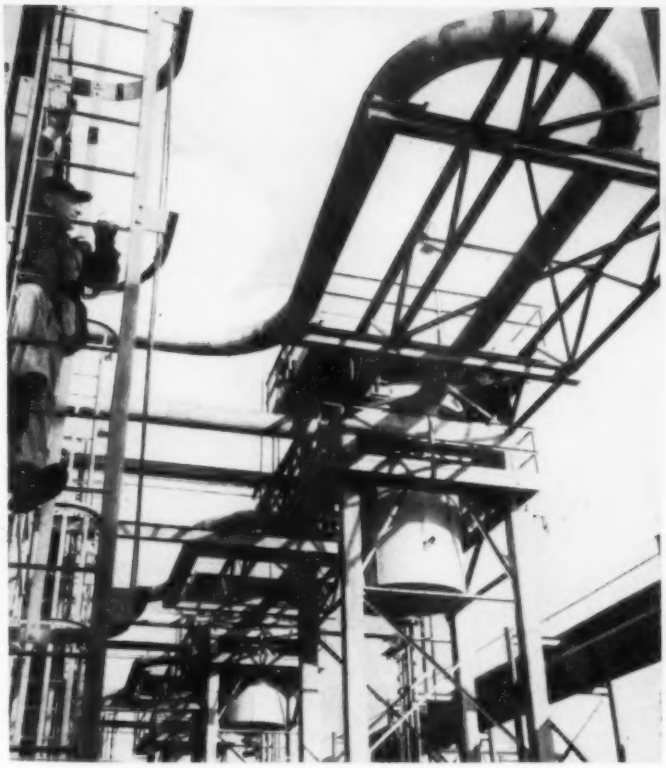
IN THIS SECTION

Organized Storehouse

Cuts out red tape, reduces capital tied up in inventory by $50,000—p. 86

Synthesis of Mesitylene

Optimum conditions for its continuous production from acetone—p. 92



Houdriformer at Sun

First step in man-size petrochemical venture—p. 83

In the Departments

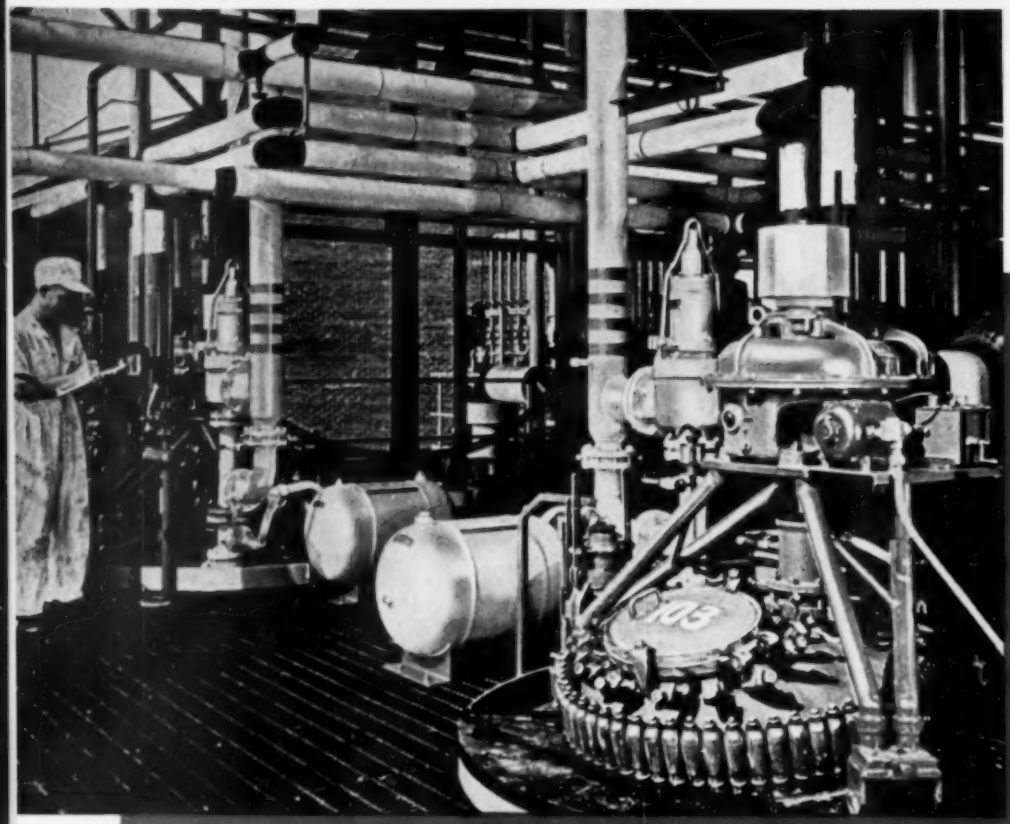
Heat Loss Graph aids in determining optimum thickness of insulation required—(Plant Practices) p. 99

New Mass Flow Meter operates on principle of gyroscope to measure weight instead of volume—(What's New) p. 130

Gas Industry Expansion may be curtailed by latest court ruling on FPC authority—(Editorials) p. 144

OTHER DEPARTMENTS BACK HERE

Lab Practices 103
Patents 105
Personals 109
Suppliers 113
Meetings 119
Operating Trends 123
Information Offered 126



Pfaudler glassed steel reactors, such as these, offer great adaptability in meeting a wide range of chemical and mechanical service requirements.

The more Pfaudler glassed steel equipment you use, the more flexibility you attain in meeting fast changing requirements. Ask us to prove it.

How the corrosion resistance of glass *plus* the working strength of steel *saves you money!*

In the fast moving chemical processing industries, equipment can become obsolete almost overnight ... heavy investments can be lost.

One answer to this problem has made sense for several decades to a lot of important companies. They buy processing equipment with an eye to the future . . . *invest* in Pfaudler glassed steel.

Changing processes no problem

There is *more* to this product than the corrosion resistance of glass plus the working strength of steel. That doesn't mean much until you know Pfaudler glass is resistant to all acids (except HF) and to alkaline solution (up to pH 12 and 212° F.). Bonded to steel by means of new techniques, there just isn't another material that offers the flexibility of use you get with Pfaudler glassed steel.

Many operating advantages

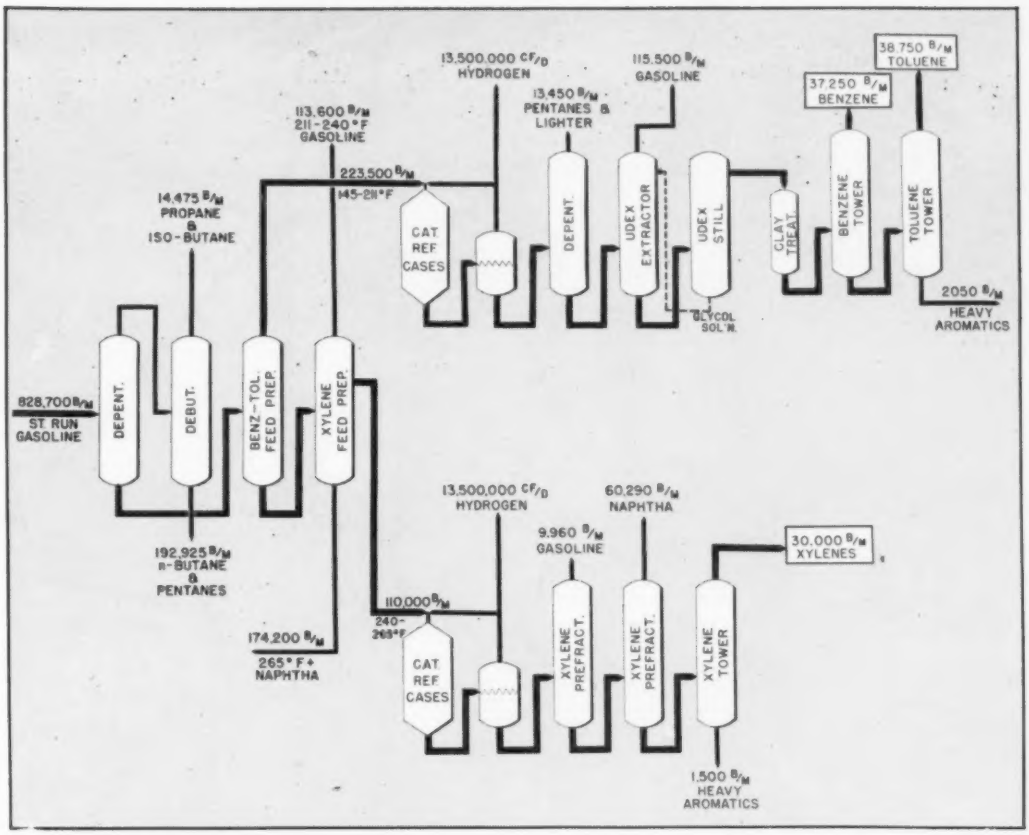
Besides giving you top corrosion resistance (eliminating metallic contamination and discoloration), Pfaudler glassed steel prevents polymers from sticking to surfaces. Heat transfer remains efficient, shutdowns for cleaning are minimized. And glass exerts no catalytic effect whatever.

Pfaudler glassed steel is available in a wide range of standard and custom-built equipment. Reactors, stills, condensers, heat exchangers, towers, pumps, valves, pipe and fittings *enable you to process in glass through every step.* When the process involves agitation, Pfaudler can tell you in advance as to the mixing action required to achieve desired results.

Guards against obsolescence

In brief, Pfaudler glassed steel enables you to guard against obsolescence, and trim your equipment costs to a minimum. Bulletin 902-G1 shows you how in more detail. Send for your copy.

THE PFAUDLER CO. **ROCHESTER 3, N. Y.**



SCHEMATIC FLOW DIAGRAM of Sun Oil Co.'s new aromatics unit at Marcus Hook

Man-Size Petrochemical Venture

First major step in Sun Oil's program is large aromatics plant in heavily industrialized area

By V. B. GUTHRIE
Associate Editor

SUN OIL CO. is the latest major oil company to get into the petrochemical industry with both feet.

Its $15,000,000 aromatics recovery plant, now being completed at the Marcus Hook, Penna., refinery, is one of the largest in the country. Design capacity is for 19,000,000 gals. of benezene annually, 19,000,000 gals. of toluene, and 15,000,000 gals. of xylene compounds.

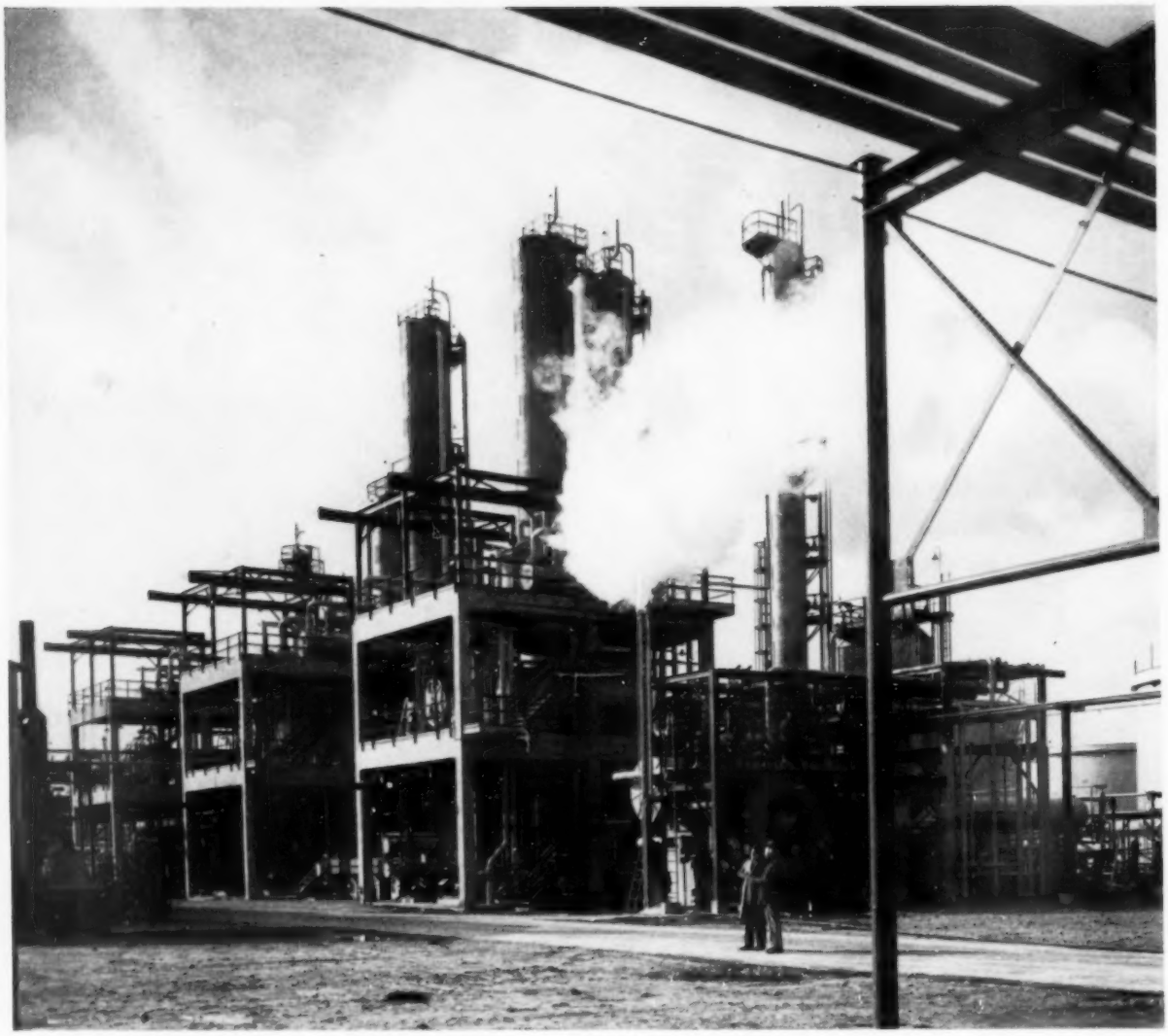
The total of 53,000,000 gals. will add around 18% to the total capacity of aromatics-from-petroleum plants in the U. S., estimated now at about 300,000,000 gals. annually. Sun's benzene capacity will be 6% of the U. S. total from all sources.

The plant at Marcus Hook consists of a prefractionator, Houdriformer, Udex recovery unit, and treating and distillation facilities.

Long range plans of Sun in the field of petrochemicals include much more than the manufacture of aromatic compounds, however. The company has an ethylene plant on the drawing board, ready to build when it can see a market outlet for over 150,000,000 annual lbs. of this product.

The Houdriforming unit at Marcus Hook will produce 13,000,000 cu. ft. daily of 95-97% purity hydrogen as a by-product. Industrial users of hydrogen are already knocking at Sun's door to take the surplus hydrogen. However, Sun sees an undisclosed use for it in its own later petrochemical operations, so it is making to long-range commitments.

Ready sales may take a little time to find for the aromatics to be produced at the new plant, company authorities appreciate. In fact, market conditions for benzene have changed since the plant was designed, and there is at present a surplus of benzene from all sources which has caused



PREFRACTIONATION SECTION OF NEW SUN PLANT, where incoming feed stock is prepared for charging to Houdriformer

a drop in price in this area. Until markets for aromatics from Marcus Hook are developed, the new plant will be operated to produce components for high-octane motor fuel and for aviation gasoline.

Future expanding markets for synthetic rubber, plastics, synthetic fibers, and other products have been under study for some time by a market research department of Sun Oil Co. Made from benzene and toluene, such materials can be advantageously served from the new Marcus Hook petrochemical plant. This research is headed by M. R. Lipkin, Philadelphia, under the supervision of J. I. Harper, assistant director of Sun's research and development department.

Although the new aromatics plant is not the introduction of Sun into the field of petrochemicals, the company considers it the first step of major proportions. Sun is already producing at its refineries such materials as propylene, trimer, and tetramer, as well as sulfonates and a new type of naphthenic acid. In 1952, the stockholders approved an amendment to the company's charter permitting it to engage further in the manufacture and sale of chemicals.

The same basic philosophy in the economics of manufacturing has been followed by Sun in building the aromatics plant that has been adopted in locating and building its refineries: 1) locate the plant in territories where good present or potential markets exist, and 2) build few but large plants.

"You can build a plant twice as large for 50% more money," is the way Clarence H. Thayer, vice president in charge of manufacturing, comments on the second point. The company reaches over 40% of the nation's population with petroleum products from two refineries—Marcus Hook, with a charging capacity of 145,000 b/d of crude, and Toledo, Ohio, with 72,000 b/d capacity.

As a result, the new aromatics plant was located in the heavily industrialized northeast section of the U. S., and incidentally it is the only oil company aromatics plant in the East Coast refining district. The feed capacity of the Udex unit is 7000 b/sd, whereas many aromatics-from-petroleum plants are under 1000 bbl. daily. Capacity production of 1240 b/sd of benzene, 1290 b/d of toluene, and 1000 b/d of xylenes together make up 2.5% of the crude charged at the Marcus Hook refinery.

The process steps in the aromatics

unit are conventional for the equipment used. Referring to the flow chart, it is seen that 30,000 b/sd of straight-run gasoline, plus about 10% of natural gasoline, are fed to the prefractionation section. (NOTE: figures shown in the chart are in terms of bbl/month.) The natural gasoline is used to add to the cyclohexane content of the feed.

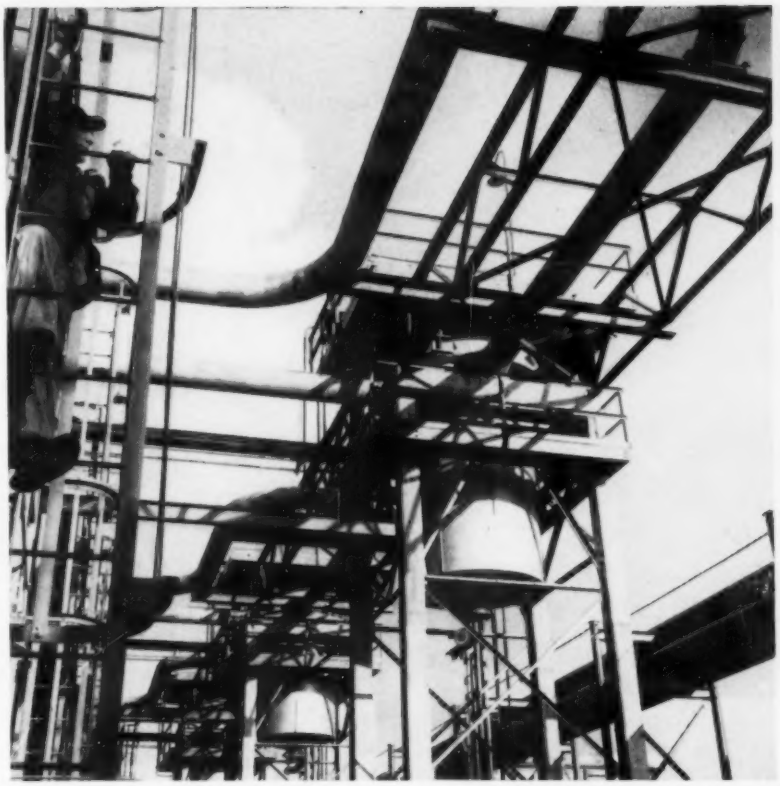
The feed stock to the Houdriformer —containing cyclohexane, methylcyclohexane, methylcyclopentane, and dimethylcyclopentanes, in addition to the benzene and toluene in the straight-run gasoline — is 11,500 b/sd in volume.

There are four pairs of cases in the Houdriformer, with a furnace ahead of each case. The platinum catalyst operates in the presence of hydrogen and at over 900° F. and 300 psi. pressure, to convert the cyclohexane and methylcyclopentane into benzene and hydrogen. The methylcyclohexane and dimethylcyclopentanes are converted into toluene and additional hydrogen. Hydrogen is recycled continuously to the catalyst cases to prevent deactivation of the catalyst, and 13,000,000 cu. ft./day is withdrawn as a valuable by-product. Recycling of the hydrogen eliminates the need for regenerating the catalyst and permits the unit to be kept continuously on stream.

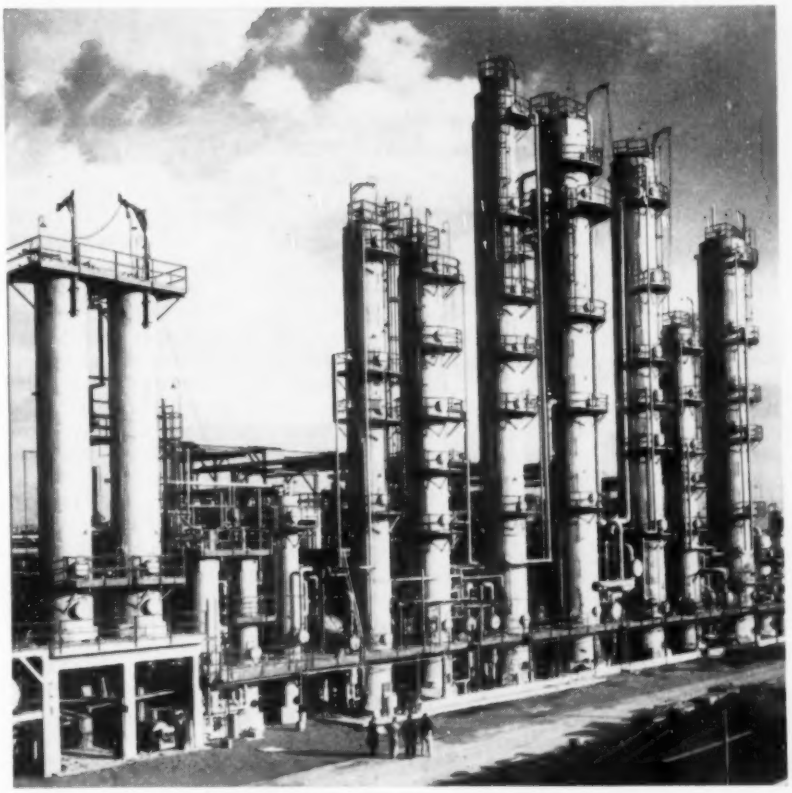
After separation of hydrogen, the liquid product from the catalytic reforming is depentanized and the bottoms, in the amount of 7000 b/sd, is charged to the Udex unit, for solvent extraction of the aromatics by diethylene glycol.

The xylene feed stock recovered continuously during the prefractionation step is stored when the Houdriformer is being charged with the benzene-toluene feed. Then the latter is accumulated while the xylene feed is being processed. In the operation of the Houdriformer on xylene, the principal difference from the benzene-toluene operation is a higher pressure —around 500 psi. Again, over 13,000,000 cu. ft. of surplus hydrogen is produced daily. The xylenes are recovered from the liquid product from reforming by careful fractionation, instead of by solvent extraction.

High flexibility was designed into the Marcus Hook aromatics plant so as to vary widely the relative proportions of the three major products, depending upon market demand. The plant can also be operated through the reforming step to make motor and aviation gasoline constituents, as economic conditions may warrant, with no production of the benzene, toluene, and xylene compounds.



HEART OF THE AROMATICS PLANT are these cylindrical reactors in the Houdriformer, filled with the platinum catalyst



PURIFICATION SECTION OF THE PLANT, including the Udex unit

SYSTEMATIC STORES at Celanese plant is exemplified by these views of careful racking of insulation and piping

Put System in Your Stores— Don't Run a "Country Store"

By JAMES E. MERCER
Celanese Corp. of America, Bishop, Texas

A SYSTEM of handling the stores materials of a large petrochemical plant with a minimum of red tape and personnel, but allowing for adequate supplies of needed materials at all times, is an important feature of Celanese Corp. of America's Bishop, Texas, plant.

It provides for a close control of inventory, an orderly purchasing procedure, and it has permitted a cut in tied-up capital invested in stores items of approximately $500,000 over the past few years.

A material classification has been developed by which in theory nearly 100 million different items can be identified and their past histories readily determined. By combining the two functions of storekeeping and purchasing into a unified department, both operations have been streamlined.

The storekeeping operations of a modern petrochemical plant closely resemble the "country store" as such were known at the turn of the century. These country stores had to stock practically everything imaginable to fulfill requirements of the isolated settlements they served. While most petrochemical plants usually are not isolated in a geographic sense, they usually are so far as certain types of industrial supplies are concerned.

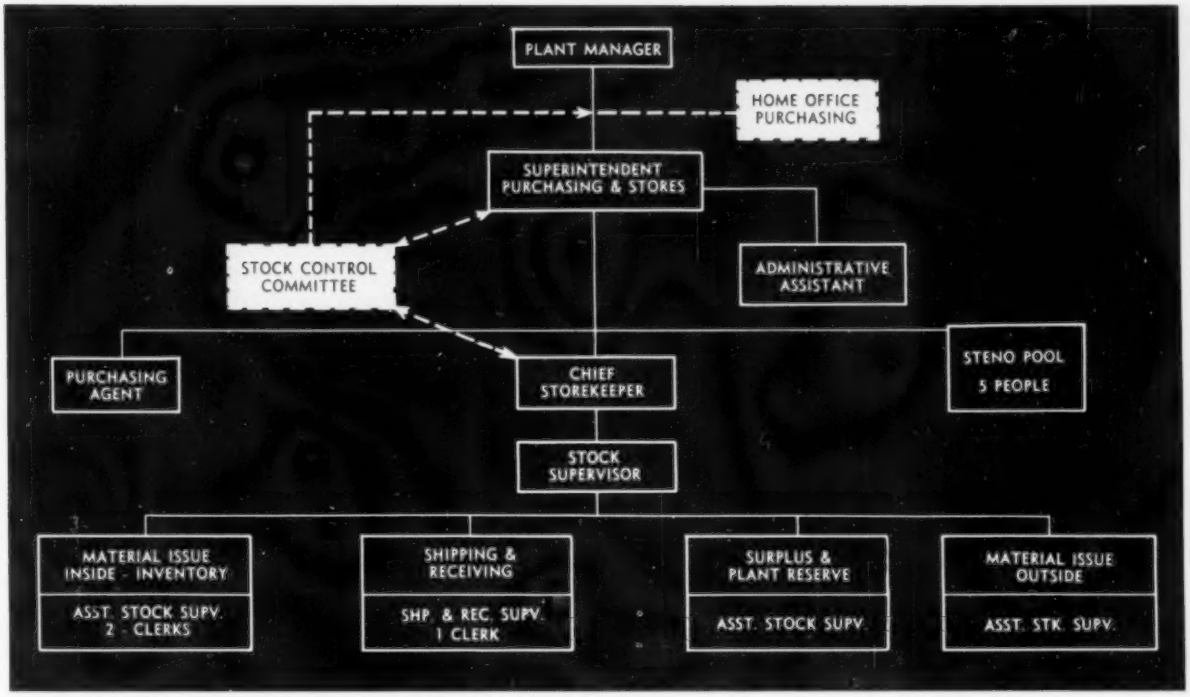
The storehouse operation of Celanese's Bishop, or "Chemcel," plant is much like the old country store except, perhaps, in the stocking of foodstuffs and harness. We purchase and disburse items ranging from radioactive materials developed in this atomic age, clothing and cafeteria supplies, down to natural items which have existed in their natural form since the beginning of time.

Under the jurisdiction of the Chief Storekeeper is about $1,000,000 worth of operating and maintenance supplies, inactive equipment, and equipment items now regarded as surplus to foreseeable needs at the chemical plant. Physically, this ranges from perhaps an unused bubble tower or pump to paper cups and pencils. This heterogeneous collection is divided into three major inventory classifications or accounts namely, "plant reserve," "surplus," and "classified stores."

The plant reserve category consists of such major pieces of processing equipment as bubble towers, heat exchangers, pumps, turbines, etc., which are not installed or are no longer in use but not considered "surplus" equipment. The second, or surplus account, includes all types of materials and equipment which, for one reason or another, have become surplus to our needs.

"Surplus" items are reported on a standard form to our central surplus disposal section at the home office in Charlotte, N. C., for handling. The surplus disposal group there, in turn, offers this material to other Celanese plants via a monthly "surplus list" or, optionally, may dispose of these materials to outside concerns.

The third category, the primary con-



KEY TO SUCCESS in stores operation is a stock control committee, working through home office purchasing and in-plant stores supervision

cern of this article and termed "Classified Stores Items," is material currently being used by the Bishop plant other than process raw material. In value it is worth approximately $600,000, involves more than 11,000 different classifications of materials under each of which there may be just one or thousands of individual items. The origin of this name is unusual but the meaning is obvious. It stems from the fact that, when the Chemcel plant was under construction it was evident that some control must be developed to restrict ordering of materials which might not be suitable for our operations for various reasons.

To accomplish this, four top supervisory personnel were named to a permanent "Stock Control Committee" under the chairmanship of the Chief Storekeeper. These include the Assistant Plant Engineer, Assistant Production Superintendent, Mechanical Superintendent and Superintendent of Purchasing and Stores. This group has classified the various items which are customarily stocked, since these materials are primarily repair parts and operating supplies; hence the name, "Classified Stores Items."

In the usual sense, the Storehouse may be thought of as only a brief stopping point for the thousands of incoming shipments of materials received annually. Disbursements approximate 100 orders daily, 260 days a year. This amounts to the staggering total of 26,000, which, when multiplied by the average of five items per withdrawal, gives a further idea of the task performed with efficiency and dispatch by some four storeroom employees.

The total personnel employed in storekeeping operations numbers 12. About two and one-half years ago the purchasing and stores groups were consolidated under one head, so that the total department employs 19 people but, until July, 1952, they were housed in different buildings. Now that a new stores building has been completed we are all together, permitting combination of clerical functions to facilitate exchange of information between the two groups. An organization chart of the department is shown in the accompanying diagram.

Considerable time savings have been made possible in the processing of requisitions because buyers are immediately able to obtain permission to substitute, revise and otherwise change material specifications. It also permits us to take advantage of quantity discounts on standard packages and special buying situations as they may arise.

Job rotation within this group is practiced so that certain personnel can perform any of the group functions during vacations and illnesses. Whenever possible, promotions are made from within the department and the situation now is such that these changes may be made with the minimum of indoctrination.

Because just 12 people handle all stores operations and also are responsible for requisitioning and receiving of all items in addition to storing and disbursements, it is obvious that an efficient materials control system must be used.

Paper work is expedited by a commodity classification numbering system which has been developed and refined in the past seven years. Basically, it is a breakdown of all our materials into 100 different major classes and dividing these into 999 sub-classes with a possibility of further identifying 999 individual items in each sub-class. Therefore, there are 100 x $(999)^2$ or 99,800,100 different identifications which can be assigned under this system.

The identification symbol which is assigned to an individual item is a "stock number" having eight digits. The first two digits represent the class, the next three the sub-class and the remaining three denote size, type and the like. Consider for an example a ¾-in. x 4-in. B-7 alloy steel stud-bolt with heat-treated nuts.

All fastenings have been arbitrarily assigned to Class No. 06. Similarly, heat-treated stud-bolts have been given the sub-class number of 320, while

Stores Operations Paper Work Simple but Complete

CELANESE CORPORATION OF AMERICA
CHEMCEL PLANT
REQUEST FOR MATERIALS

Nº 13708

SYMBOL NO	Quantity Required	DESCRIPTION OF MATERIAL	Quantity Delivered	PRICE	TOTAL
[illegible]	4	1/2" 150 lb. Brass Screwed Gate Valve	4		
[illegible]	2	1/2 x 1/2 O.S. Cooper Nipple Lgth. 6"	2		
[illegible]	4	1/2" 90° Cooper Elbow ea.	4		
[illegible]	4	1/2 x 2 Galv. Nipples Lgth. 6"	4		
[illegible]	4	1-1/2" Pipe Plug O.S. Amer. Std. Square Thread	4		

Charge to

DAYTIME ROUTINE requests for materials and equipment are handled by the Stores department on an "issue ticket" made out like this, showing the code symbols for the various items

16904-530

Ring, 106A rubber on cooling water connection for Model CCG-8 Worthington Engine serial G-1454

Sec. 11A Row 4 Bin 15

NIGHTS AND WEEKENDS, operating supervision uses this "material locator system" consisting of 3x5 file cards like these to help them find needed items for emergency use

SYMBOL 06525-018 LOCATION 7RA-3-5

O. H.	DATE ORD.	QUAN.	DATE REC.	QUAN.
0	9-15-8	50	11-11-48	50
0	9-12-51	100	10-8-51	100
18	10-25-51	100	11-12-51	100
23	1-25-52	100	2-6-52	100
12	1-7-53	25	1-16-53	25
25	1-29-53	50	2-25-53	50
17	9-15-53	25		

1¼" Nuts, Hexagon, Carbon Steel, Semi-finished class 2 fit, Amer. Std. heavy,

MIN.	DESCRIPTION
25	threaded Amer. Std. Coarse Thread as per ASA Std. B1.1.

PRINCIPAL RECORDS kept by the Stores department include the "bin ticket," the "stock record card," and the "inventory count slip."

The bin ticket (above) with a code number for the specific item in the bin and a description, carries an inventory minimum. When the bin contents drops below this minimum, the ticket goes to Storekeeper, for reordering that item, and is then returned to the bin

CELANESE CORPORATION OF AMERICA
CHEMCEL PLANT
INVENTORY COUNT SLIP

SYMBOL NUMBER 47108-600 BLDG. SEC. 4B ROW 5 BIN 19

DESCRIPTION

Bearings, ball, SKF 6308NR, Fafnir 308KG, N.D. 43308, MRC 308SG

UNIT 1:05 P.M. 11:09 A.M. 3:30 P.M.

Inv. Date	Initials of Counter	Whse. Count	Card Balance	Price	Overage	Shortage	Adjust. Made By	Ref.
12-8-49	Fain	2	2	-	-	-	JHN	
5-2-51	Duncan	7	8	4.10	-	4.10	JHN	
7-30-53	True	9	9	-	-	-	LH	

INVENTORY COUNT SLIPS help reconcile the actual flow of materials through the stores department

CELANESE SYMBOL NUMBER 06525-018 PURCHASE UNIT ONLY GROUP NO. STK. MIN. 25

DESCRIPTION

ONLY - 1¼" Nuts, Hexagon, Carbon Steel, Semi-finished class 2 fit, Amer. Std. heavy, threaded Amer. Std. Coarse Thread as per ASA Std. B1.1.

PLT. LOC. BLDG. LOC. SEC. 7RA ROW 3 BIN 5 YEAR 1948 CARD NO. 1

Requ. No.	Date	Quan. on Hand Rec'd.	Quan. on Hand Bthce.	90 Days Issues	Quant'y Ordered Appro.	Quant'y Ordered Main.	DATE Req'd.	DATE Rec.	REMARKS	App'd.
06-0266	9-15-8		0			50	11-15	11-11-48		
14287	9-12-51		0			100	10-1-51	10-8-51		
15204	10-25-51		18			100	11-12-51	11-12-51		
16680	1-25-52		23			100	2-18-52	2-6-52		
22845	1-7-53		12			25	1-19-53	1-16-53		
23397	1-29-53		25			50	2-16-53	2-25-53		
28394	9-15-53		17			25	9-28-53			

STOCK RECORD CARDS provide permanent information on each item and are filed numerically by their respective code symbol numbers

this particular size carries an item number of 170 in the Celanese system. The complete stock number, therefore, is 06320-170. This number is posted on storage bins, written on disbursement tickets, carried on material receiving reports, requisitions, stock record cards and all other documents that in any way have to do with storehouse handling of this particular item. A complete history of this or any other item may be obtained simply by using the stock number as a key and referring to the proper records.

This system alone has greatly facilitated the handling of such a large volume of material with a minimum of personnel. Although no claim is made for the originality of the system, since it is the work of several individuals as a result of their considerable experience, it has proved so successful it now is being placed into effect in all domestic Celanese plants. A company-wide catalog, now in process of compilation, not only will show all these items but by an additional code symbol will indicate which Celanese plants customarily stock a specific item. Another catalog, issued only to certain plant departments, is limited to items stocked at Bishop.

Still another advantage of the classified stores system is that it will permit reductions in an as-yet unknown number of stores items by indicating duplications among many manufactured items.

For instance, our plant might well have six different makes in several sizes of pumps. The same size and rating of bearings might be used among a number of those pumps. But, to consult each manufacturer's parts list will very easily give the impression that it is necessary to stock say, nine different bearings under the individual parts list requirements. Actually, only a few specific sizes of bearings might be needed, obtainable from perhaps three different local bearing suppliers.

Thus, what originally may have called for stocking a large number of ostensibly different bearings, in reality might be boiled down to a relative few and still cover all pump-bearing needs. The same holds true for lock-washers, many nuts, bolts, packings and a host of other items because, under the Celanese stock number system, identical items have the same stock number regardless of where they may be used.

It is of interest also to note that all of the major classes under the stock number system are not yet assigned. Several class numbers and many subclass numbers still are in a "reserve for future use" status even though the system is being extended company-wide to cover a great diversity of operations, of which petrochemical manufacturing is only a part.

All items are released to plant departments in exchange for a disbursement slip or "issue ticket." This carries the date, time, description of items wanted, a brief description of the job involved and the account number to which it is to be charged. The account number used also indicates the end-use: for operating supplies, new construction or repair of specific equipment. The *"PO A&B Unit"* end-use with an "M" account number for the ticket shown in the illustration refers to maintenance replacements at primary oxidation units *A* and *B*, for instance.

Every major piece of capital equipment in the Bishop plant carries a plant number, whether or not it also has a manufacturer's serial number, figure number, or the like. (The latter, when available, is carried on inventory cards also to expedite parts ordering.) Such cross-keying is invaluable in maintenance records to indicate replacement and repair experience and is of special interest to the engineering department.

These "issue tickets" also show the issuing authority's signature and the names of employees receiving and disbursing the materials covered for accounting control. From these the various accounts are charged and the information is used to check against inventories.

When materials are requisitioned for a specific job, either by Stores or other departments, they are moved to the jobsite upon receipt. Where the magnitude of the project justifies it, a Stores employee is assigned to disburse the material. Experience indicates that this method of handling materials and equipment expedites construction to a considerable degree.

The Storehouse is manned only five days weekly except under special circumstances, but the plant is in continuous operation. This made mandatory the development of a "material locator system" which is utilized by shift superintendents (who have a key) at night and on week-ends should issuance of stores materials be necessary. No attempt has been made to include all items in this system and it is confined in the main to spare parts.

These cards are filed alphabetically according to manufacturer and part name. The card carries the aisle and bin number, along with stock number and other pertinent information. We have found that this system has reduced emergency call-outs of stores personnel to practically nil.

The other principal records used by Stores are the "bin ticket," "stock record card" and "inventory count slip." The bin ticket is a small tag which gives the classification system number for the item in the bin, its location and a description of the material. It also carries an inventory minimum. When an employee finds the bin contents below the minimum, the ticket is "lifted" and passed to the Storekeeper for reordering. Date and quantity ordered are posted and the card returned immediately to the bin; the same pro-

Meet the Author

Mr. Mercer

James E. Mercer, superintendent of purchasing and stores at the Celanese Corp. of America's Bishop, Texas, petrochemical plant, has followed this line of endeavor throughout his working career.

Formerly associated with one of the major oil companies, he joined Celanese in October, 1946, as chief storekeeper. Successive promotions ensued, and when the purchasing and stores departments of the Bishop plant were consolidated in 1951, Mr. Mercer was selected to head the combined departments.

Born in Crowell, Texas, Mr. Mercer received his schooling at several south Texas institutions. He has also taken business courses at Corpus Christi and a number of engineering courses at the University of Texas' vocational education department.

He resides in Corpus Christi with his wife and small son. Mr. Mercer is a member of the Houston chapter of the National Purchasing Agents Ass'n. and is active in the Gulf Coast Purchasing Agents Ass'n. in Corpus Christi.

cedure is followed when the restock quantity is received.

The stock record card is a permanent record of this item from the time it was first permanently stocked. In addition, it shows requisition number, quantities on hand, ordered, and date received. It may show plant location where the item is used and always its location in the storehouse if a regularly stocked item.

The inventory count slip is used to reconcile the actual flow of materials through Stores. Periodic inventory is taken and the result balanced against accounting department records. The form shown in the illustration is for a type of ball-bearing and shows differeent manufacturer's numbers for the same bearing.

Since the Chemcel plant continues to expand, consideration is being given to material deliveries from the Storehouse. Now, all material withdrawals are made by individuals presenting issue tickets in person. If delivery service is inaugurated, all requests will be handled by telephone and deliveries made at specified times to previously designated permanent locations.

Standardization studies are being carried on constantly by Storehouse personnel in cooperation with members of the engineering and maintenance departments. As indicated earlier, through such studies the stocking problem can be simplified by indicating interchangeability of repair parts. As a practical example, the stock of roller and ball bearings has been reduced about 75%. These studies and the growing availability of materials should permit further inventory reductions.

Very close coordination between our department and the engineering and mechanical departments is necessary since the latter two are responsible for the majority of requisitioned materials. The engineering department prepares bills of materials for all projects. These are transmitted to Stores for preparing requisitions when on-hand stocks are inadequate. Stores also suggests substitutions of surplus materials, less costly items and the like. As soon as it is known that Stores materials are to be used on projects, required items are physically tagged with a "reserve" notation for that particular job, not to be removed until withdrawal is made.

Mention of the stock control committee has previously been made. In addition to developing the classification system, one of the principal responsibilities of this group is to constantly screen all materials currently being carried in stock. This is indeed another reason for selecting top supervisors as members, for their combined knowledge gives them familiarity with every part of the plant—operation, process requirements, company policies and future plans.

Systematically, this group constantly examines the issue history of particular repair parts items in the light of inventory records. With their combined knowledge and experience it may be determined that only one or two of an item need be kept on hand—valves for a certain type of compressor, for instance. Where it once was customary to replace five of these annually, current experience indicates only two or three now are used per year and then at widely spaced intervals. Now that these valves are readily obtainable, the committee may decide to cut the inventory level to one or two.

Stock items which have been supplanted by different or improved versions are declared surplus or scrapped. Where excessive stocks have accumulated through construction left-overs or for other reasons, steps are taken to bring quantities down to practical inventories. Surplus declarations, sales to outside concerns and, in some cases, return of the material to the original supplier bring about the reduction.

Another prime responsibility of this committee is to screen all requests for materials to be added to classified stores. This does *not* mean, however, that a committee meeting has to be called before something needed can be bought, but the committee *will* consider it before it is permanently stocked.

The mechanism for a permanent addition to stores items operates in this manner. All requests for additions first must be approved by the appropriate department head before submission to the committee. Not a few requests are dropped at this point. The request must be on a form devised by the committee, wherein it must be fully justified. Additional comments may be furnished either in writing or verbally. The committee then makes a decision with the greatest care, since its findings (on a majority-rules basis) can be over-ruled only by the plant manager.

Ordinarily, the routine goes like this for a part not customarily stocked. Assume the item is a new pump impeller. The machinist foreman would initiate a purchase requisition after checking, if necessary, to be sure it is not carried by Stores. The mechanical superintendent would add his approval (he is a member of the Stock Control Committee) and forward for action by the plant manager, whence the requisition goes to Purchasing. The elapsed time can vary from a maximum of five hours to about 20 minutes, depending on urgency, as approval can be handled verbally (if emergency), by special messenger or normally by plant mail.

When the requisition involves replacement or purchase of a new capital item, whether to be considered for permanent stocking or otherwise, it is issued by the Engineering Department. No capital items are requisitioned by Stores unless previously approved through Stock Control Committee action as "Classified Stores" items.

The operation of the plant salvage department administratively is entirely separate from the Stores, although the two work together very closely. Reconditioned items are stocked by the salvage department and not returned to Stores for issuance. (Any repair parts necessary are secured from Stores, however.) When a unit desires salvage material it deals directly with the salvage department. Stores may, however, requisition material from salvage. In any event, no system of "paper profit" is involved; we feel that such systems are merely transferring money from one pocket to another and the true value of a salvaged item is only the material and labor which was required to return it to usefulness. When the salvage department has sufficient segregated scrap on hand to warrant disposal, the transaction is handled by Purchasing and Stores in the same manner as any other surplus material approved for outside sale.

Parts for control instruments and the instruments themselves are not stocked by Stores. Since this is a highly specialized operation, disbursing instrument parts is handled as a function of the instrument department. Electrical components such as wire, conduit, tubing, etc., are stocked by Stores.

All purchasing is done by specifications when possible. A manufacturer's catalog designation is referred to only when necessary. These specifications are prepared in close collaboration with the engineering department. There is no formal review program to keep specifications "up to date," but in practice they are under constant review on the basis of recommendations by plant personnel and from discussions with equipment suppliers.

This arrangement is not intended to imply that specifications are allowed to become obsolete or unduly restrictive on suppliers. In fact, we find it most desirable to use standard rather than "special" items whenever possible.

The physical arrangements of the Stores operation are not unusual. In line with long-range planning, it is our ultimate aim to provide storage for all Stores items at one location.

FROM THE GHOSTS OF THE PAST . . . SPRING THE COMPANIES OF THE FUTURE!

Announcing a **NEW** Advertising Series

"THE BRAND OF PROGRESS"

By Heat Exchanger Specialists

▲ It was 1909 when the photographer squeezed the bulb on his camera and film-recorded the top photograph. Western Supply Company, a small machine shop engaged in the repair of cable-drilling tools, had been in business for three years. At that time there were no gleaming rails to the South of the infant company and machinery was delivered by buckboard over muddy, rutted streets.

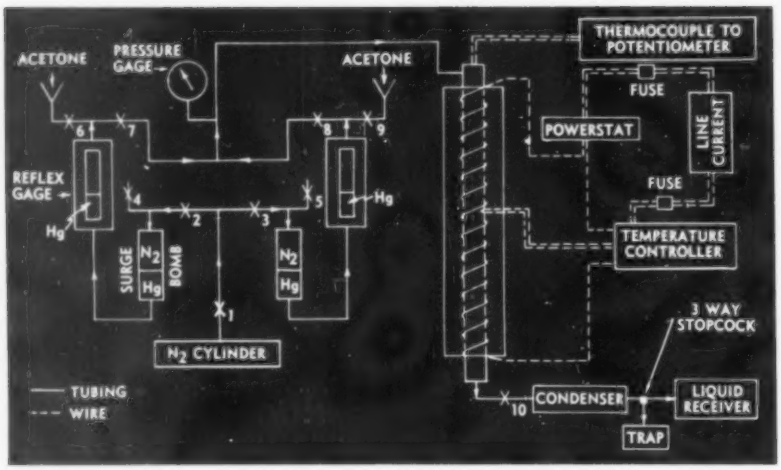
But both the Southwest and Western Supply expanded as the vast oil fields of the area were discovered and opened for production. This expansion gave birth to the vital need for machines and craftsmen to manufacture refinery equipment for processing the new-found oil. It was this condition in 1936 which channeled Western's facilities toward the manufacture of heat transfer equipment.

Today, Western is counted as one of the primary manufacturers of all types of heat exchangers. The big Western "W" can be seen in the largest plants of the Petroleum, Chemical and Petro-Chemical industries — ample testimony to Western's ability to keep pace with these rapidly expanding fields.

An advertising series titled, "The Brand of Progress" will present the reasons behind the growth of Western Supply Company. Follow this series in this magazine.

WESTERN
HEAT EXCHANGERS
TEMA
Manufactured by
WESTERN SUPPLY COMPANY
P.O. BOX 1585 TULSA, OKLAHOMA

 (To obtain more data on advertised products see page 128)



ALIPHATIC TO AROMATIC—schematic flow diagram of acetone-to-mesitylene process

CONTINUOUS METHOD FOR *Synthesis of Mesitylene from Acetone*

By KENNETH A. KOBE and LEO J. HIRTH

The University of Texas

CONTINUOUS catalytic processes for converting aliphatic to aromatic hydrocarbons in the petroleum processing industries are not new. Many catalytic reforming operations give dehydrocyclization for this conversion. With the proper feed stock, some of the simple aromatics are being produced in large quantities.

There are other reactions that are specific for the production of one particular compound. One such reaction is the condensation of acetone with itself to form mesitylene (1, 3, 5-trimethylbenzene).

Continuous flow preparation of mesitylene by the catalytic condensation of acetone has resulted in yields of 21.3%, based upon the original acetone charge to the reactor. This mesitylene fraction boiled from 155-170° C. On purification with metallic sodium, a mesitylene fraction boiling from 163-167° C. was obtained in 10.7% yield. Its refractive index was $n_D^{25} = 1.4890$.

A relatively cheap catalyst, natural bauxite, activated at 900° C. for one hour, gave maximum yields. Reaction conditions were 1000 psig. and 700° F. at an average space velocity of 0.35 cc. acetone per cc. catalyst per hr. Usually, 25-35% of the acetone did not react and it could be recycled along with intermediate by-products to raise the ultimate yield.

Decreased yields occurred where catalyst activation was at 600° C., where bauxite was treated with phosphoric acid, and where Alcoa activated alumina was used as a catalyst. Regeneration of the spent catalyst was found to reduce yields but the regeneration equipment and technique were undoubtedly inadequate. Space velocities above 0.35 gave sharply lowered yields. Pressure had little effect between 750 and 1500 psig. Temperatures of 590 and 800° F. caused a marked decrease in the yield.

Acetone is being produced more extensively in the petrochemical industry from the oxidation of light hydrocarbons, such as propane and butane. The new phenol process being started in several commercial scale plants oxidizes cumene to form phenol and acetone.[1] Isopropanol, produced in large quantities from propylene, is easily dehydrogenated or oxidized to acetone. Hence, the supply of acetone is becoming more abundant.

Mesitylene, the symmetrical 1, 3, 5-trimethylbenzene, has been used for the preparation of certain dyestuffs. However, its use on a large scale has not been possible because of the high cost of this hydrocarbon. The catalytic preparation of mesitylene from low cost acetone (current market is 8-11¢/lb.) would do much to decrease the cost and increase the use of mesitylene.

Previous experiments have shown that solid catalysts of the alumina type possess the ability to convert acetone to mesitylene at elevated temperatures and pressures. This paper reports the optimum conditions for preparing mesitylene on a continuous flow basis utilizing this type of catalyst.

Acetone undergoes aldol condensation type reactions readily, especially with vigorous condensing agents, such as strong acids. Whitmore[9] postulates the following reactions for the formation of mesitylene from acetone:

$$CH_3COCH_3 + CH_3COCH_3 \longrightarrow CH_3COCH_2COH(CH_3)_2$$

$$CH_3COCH_2COH(CH_3)_2 - H_2O \longrightarrow CH_3COCH{:}C(CH_3)_2$$

$$CH_3COCH{:}C(CH_3)_2 + CH_3COCH_3 \longrightarrow C_6H_3(CH_3)_3$$

and

$$\longrightarrow (CH_3)_2C{:}HCCOCH{:}C(CH_3)_2$$

Route is: acetone (b.p. 56° C.) to diacetone alcohol (b.p. 166° C.) to mesityl oxide (b.p. 131° C.) to mesitylene (b.p. 165° C.) and phorone (b.p. 198° C.). The condensation step with the third molecule of acetone can occur in a somewhat different manner to give phorone, an unsaturated aliphatic ketone.

Condensation agents which have been used to produce mesitylene from acetone have been concentrated sulfuric acid, zinc chloride, hydrochloric acid, silica gel, alumina, and bauxite. The recommended synthesis employing concentrated sulfuric acid, as described in Organic Syntheses[2], produces yields of 13-15%.

Of particular interest is Ipatieff's work[6], using alumina as the condensation agent for acetone. In a 10-12 hr. reaction period at 350-450° C. and 100 atmospheres pressure, he obtained mesitylene as the principal product in

Table 1—Summarized Data

Run	Catalyst	Treatment	Average Space Velocity	Pressure, psig.	Temp., °F.	Mesitylene Yield (%) (b.pt. 155-170°C.)
1	Bauxite	600°C-1 hr.	0.30	1000	700	.....
2	Bauxite	600°C-1 hr.	0.71	1000	700	.....
3	Bauxite	600°C-1 hr.	0.28	1000	700	15.4
4	Bauxite	900°C.-1 hr.	0.39	1000	700	20.6
5	Bauxite	600°C-1 hr.	1.41	1000	590	12.3
6	Alcoa Alumina	None	0.21	1000	700	.....
7	Alcoa Alumina	None	0.76	1000	700	8.4
8	Alcoa Alumina	900°C.-1 hr.	0.50	1000	700	7.4
9	Bauxite	900°C.-1 hr.	0.51	1000	590	3.1
10	H_3PO_4 on Bauxite	650°C.-2 hr.	0.35	1000	700	5.6
11	Bauxite	900°C.-1 hr.	0.35	1000	700	21.3
12	Bauxite	900°C.-1 hr.	0.31	1000	800	11.9
13*	Bauxite	900°C.-1 hr.	0.33	1000	700	20.2
14	Bauxite	600°C-1 hr.	0.21	1000	800	12.4
15	Bauxite	600°C-1 hr.	0.32	750	700	17.0
16	Bauxite	900°C.-1 hr.	0.65	750	700	6.8
17**	Bauxite	900°C.-1 hr.	0.33	1000	700	9.4
18	Bauxite	900°C.-1 hr.	0.29	1250	700	15.5
19**	Bauxite	600°C-1 hr.	0.31	1000	700	11.4
20	Bauxite	900°C.-1 hr.	0.31	1500	700	17.5

* Recycled condensation product from Run #11.
** Regenerated catalyst.

30% yield. Other products in this batch process were mesityl oxide and phorone. Dohse and Schuster in a patent[4] claim yields ranging from 40-60% and specify a natural alumina hydrate, partially or completely dehydrated at 300-1000° C., with operation at 150 to 300° C. and 150 to 300 atmospheres.

Subsequently, Ipatieff and Linn[7] modified the natural alumina catalyst by the deposition of heteropolyacids like phosphotungstic and silicotungstic acids. At temperatures from 200-450° C. and at 100 atmospheres pressure, yields ranged from 8-24%. The inclusion of chromium, magnesium and molybdenum oxides with the alumina did not improve these yields and the substitution of aluminum chloride for the alumina actually caused a marked decrease.

Elliott and Hirth[5] condensed acetone by using a natural bauxite catalyst in a rocking type hydrogenation autoclave. Following a ten hour reaction period at 285° C. and 200 psig., a 17% yield of mesitylene resulted.

Experimental apparatus: Since previous investigators had shown the feasibility of catalytic condensation of acetone on a batch basis, it was desired to operate on a continuous flow basis in this work. A schematic diagram of the equipment is shown in the drawing.

Nitrogen gas displaced mercury from the surge bombs into the reflex gages, whereupon the acetone was forced into the reactor from the gage. Products leaving the reactor were cooled by passage through a short metal double pipe heat exchanger.

Steel needle valves were used to preclude the possibility of amalgamation with mercury. Likewise, the ⅛-in. tubing and the "Ermeto" fittings, rated at 6000 psi., were made of steel. The 90-cc. reflex gages, which were calibrated, permitted visual observation of the flow rate by noting the movement of the acetone-mercury interface.

The reactor incorporated ideas from Dilley and Edwards[3] and Ipatieff, Monroe, and Fischer[8]. It consisted of a 3-ft. length of extra strong 1½-in. O.D. steel pipe, with caps for both ends. The tightening of four screws in each cap against case-hardened steel plates, which bore on copper gaskets, insured a gas-tight seal.

Provision was made to preheat the acetone before it contacted the catalyst. A steel catalyst tube supported 100 cc. of catalyst on a perforated plate and was located centrally in the reactor. Removal of the lower cap from the reactor permitted withdrawal of the catalyst tube for recharging with fresh catalyst.

The reactor was heated by nichrome resistance wire wound around the reactor. A thermocouple well in the catalyst bed allowed the temperature of the bed to be measured. Temperature regulation, ±5° F., was effected by the insertion of a millivoltmeter pyrometer controller in the heating circuit. A 2-in. layer of 85% magnesia reduced heat losses from the reactor.

Materials: Commercial grade acetone was treated with calcium chloride to remove water and distilled to obtain a refined acetone. The purity was checked by refractive index.

Both a regular grade of Arkansas bauxite and an activated commercial alumina were used as catalysts, the former being obtained from the Alcoa Mining Co., Bauxite, Ark., and the latter from the Aluminum Ore Co., East St. Louis, Ill. Particles of 10-20 mesh size were heated to various temperatures for varying lengths of time to activate the catalyst. In one instance, the bauxite was treated with an 85% phosphoric acid solution prior to activation.

Procedure: Typical run procedure began with the removal of spent catalyst and its replacement with fresh catalyst. The system was then flushed with carbon dioxide to remove waste gas or liquid remaining, after which the reactor was shut off from the feed system. While the reactor was heated slowly to the desired temperature, the reflex gages were filled with acetone.

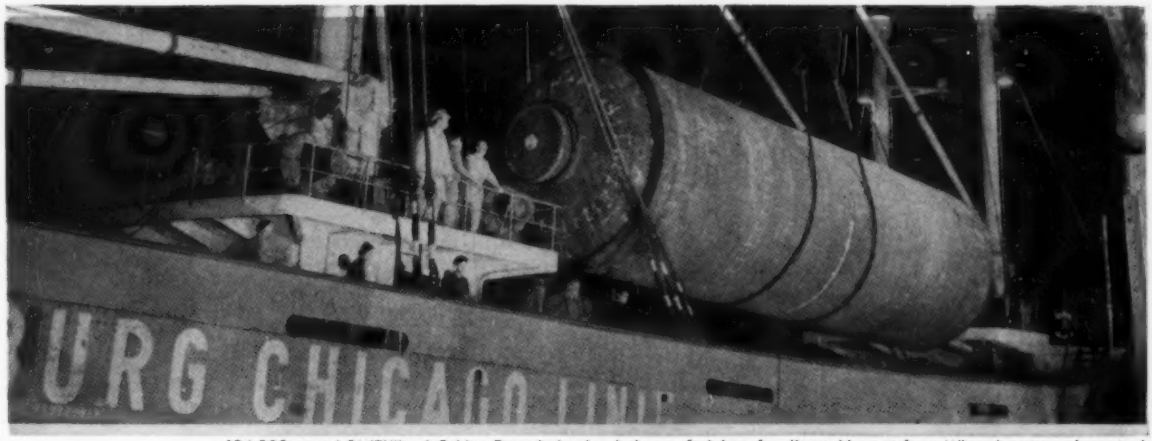
When the reactor was at the desired temperature, the nitrogen cylinder valve, X1, was opened slightly and acetone was forced into the reactor. (See diagram.) Opening valve X10 permitted the reaction products to escape after the proper pressure level was attained.

By suitable adjustment of valves X1 and X10 the pressure, temperature, and the flow rate were stabilized so that the liquid products could be collected under equilibrium conditions. No attempt was made to collect the gaseous products. The duplicate feed system permitted continuous operation.

The liquid product formed two immiscible layers, the upper one was a transparent yellowish-brown in color and contained mesitylene and other

A. O. Smith for outstanding advantages

3 plants on waterways



124,000-pound SMITHlined Coking Drum being loaded on a freighter for direct shipment from Milwaukee to an important refinery in Germany via the Great Lakes-St. Lawrence Seaway to Hamburg. Its dimensions are 14 feet ID, 53 feet length.

Our Milwaukee, Houston and Los Angeles vessel plants are all on waterways providing economical, direct transportation to domestic and foreign ports.

From these plants, direct shipment of the largest pressure vessels and heat exchangers can be made economically. This gives our customers, whose processing plants are convenient to waterways, important advantages and economies.

Their erection problems and expenses are cut considerably when fractionators, converters, accumulators and other large size processing vessels can be delivered in one or, at most, two pieces. Field assembly costs are avoided or greatly reduced and much time is saved.

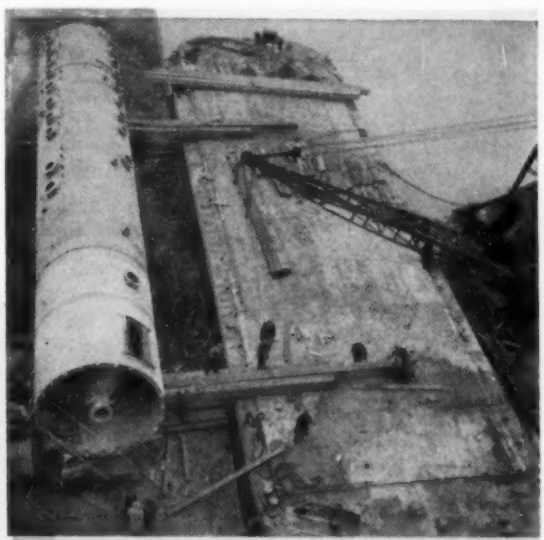
For further information about A. O. Smith pressure vessels, heat exchangers, and the outstanding advantages our customers enjoy, we invite you to write our Milwaukee office.

A.O. Smith CORPORATION

VESSELS AND HEAT EXCHANGERS

MILWAUKEE HOUSTON LOS ANGELES
International Division: Milwaukee 1, Wisconsin

A 299,000-pound vacuum tower being loaded on a barge for shipment from Houston to New Orleans through the Intracoastal Canal. There, it was loaded on a steamer and shipped to South America. It is 18 feet in diameter, 64 feet in length.



A 320,000-pound SMITHlined Fractionating Tower being unloaded at Whiting, Indiana. It was barged down Lake Michigan from Milwaukee. It is 16 feet in diameter, 107 feet in length, and shop-fabricated in one piece to avoid costly field assembly before erection at the refinery site.

hydrocarbons. The colorless lower layer was largely acetone and water. The mesitylene layer was fractionated and at 10° C. intervals the distillate volume was noted. The 130-210° fraction, pale green in color, was treated with sodium metal to remove ketonic impurities, allowed to stand overnight, and redistilled.

Results: Data are summarized in Table 1. Mesitylene fractions were collected from 155-170° C. and, following purification, from 163-167° C. Calculated yields are based on the total amount of acetone charged to the reactor. The highest yields of mesitylene (21%) occurred in Runs 4 and 11, using a bauxite catalyst activated for one hour at 900° C. The reaction conditions were 700° F. and 1000 psig. with average space velocities of 0.39 and 0.35, respectively.

These results compare favorably with the 24% yield obtained by Ipatieff and Linn[7]. Although the temperatures and pressures are comparable, the bauxite catalyst is considerably cheaper and easier to prepare than a complex heteropolyacid catalyst. The 40-60% yield claimed by Dohse and Schuster[4] is based moreover only upon acetone which has reacted and no boiling range is specified for the product. Recalculation of these yields on the basis of conversion per pass would probably lower them somewhat since from 25 to 35% of the acetone is recovered unchanged. The best yields in this experiment exceed the 17% reported by Elliott and Hirth[5].

With regard to other condensing agents like hydrochloric and sulfuric acids, zinc chloride, and silica gel, it may be said that the use of activated natural bauxite offers comparable or better yields. Concurrently, the disadvantages of corrosiveness and batch operation are overcome.

Process variables studied were the type of catalyst and its treatment, the space velocity, pressure, and the temperature. Activation of the bauxite catalyst at 900° C. for one hour gave higher yields than at 600° C.

Extremely poor yields were found for phosphoric acid treated bauxite in Run 10, and the commercial Alcoa activated alumina gave a maximum yield of only 8.5%.

Regeneration of spent catalyst at both 600 and 900° C. gave relatively lower yields of 11.4 and 9.4%, respectively. This decrease in yield was probably caused by the limited amount of oxygen available in the small furnace space wherein the regeneration occurred. Provision for occasional stirring of the catalyst and a fresh air supply would have been desirable.

The desirability of high space velocities, synonomous with high throughput, is counterbalanced by the minimum catalyst contact time required for the reaction to occur. A fairly low space velocity of 0.35 cc. acetone/cc. catalyst/hour produced the highest mesitylene yields. Higher space velocities decreased yields and led to considerable gas evolution.

Although the best yields occurred at a pressure of 1000 psig., any pressure between 750-1500 psig. appeared favorable for the reaction and the exact value is not too critical. Temperature, on the other hand, had a marked influence on the reaction. Noticeably lower yields were obtained at 590° F. and at 800° F. A value of 700° F. would appear best for this reaction.

The effect of recycling some reaction by-products is shown in Run 13. The throughput included 19.5 cc. of a 150-210° C. cut, minus the 160-170° C. portion, plus 55.5 cc. of a 50-130° C. fraction, which contained 95% acetone. The resultant yields duplicated the best yields of Runs 4 and 11, which indicates the feasibility of by-product recyclization to increase the ultimate yield of mesitylene.

The synthesis of mesitylene by the catalytic condensation of acetone seems to offer excellent yields compared to other processes. In addition, the bauxite method offers all the advantages deriving from continuous operation plus a cheap, plentiful, readily activated catalyst.

References

(1) Sherwood, Peter W., "Synthetic Phenol Manufacture;" PETROLEUM PROCESSING, Vol. 8, No. 9, pp. 1348-1354, Sept., 1953.

(2) Adams, R., and Hufferd, R. W., *Organic Syntheses, Collective Vol. I*, p.334, John Wiley & Sons, Inc., New York (1947).

(3) Dilley, J. R., and Edwards, W. L., "A High Presure Gas Compression System," U.S. Dept. of Agriculture Circ. No. 61 (Jan. 1929).

(4) Dohse, H. and Schuster, C., "Production of 1,3,5-trimethyl Benzene," U.S. Patent 1,977,178 (Oct. 16, 1934).

(5) Elliott, J. F., and Hirth, L. J., "Preparation of Mesitylene from Acetone," Chem. Eng., 378 Report, University of Texas (May 13, 1947).

(6) Ipatieff, V. N., *Catalytic Reactions at High Pressure and Temperatures*, p. 469, The MacMillan Co., New York (1936).

(7) Ipatieff, V. N., and Linn, C., "Process for the Production of Trialkyl Benzene," U.S. Patent 2,425,096 (Aug. 5, 1947).

(8) Ipatieff, V. N., Monroe, G. S., and Fischer, L. F., "High Pressure Laboratory Flow Apparatus," *Ind. Eng. Chem.*, Vol. 40, p. 2049 (1948).

(9) Whitmore, F. C., *Organic Chemistry*, p. 253, D. Van Nostrand & Co., New York (1937).

Meet the Authors

Dr. Kobe

Mr. Hirth

Kenneth A. Kobe has been graduate professor of chemical engineering at the University of Texas since 1941, except for two years spent with the Chemical Warfare Service.

After receiving his doctorate in 1930 at the University of Minnesota, he spent a year in industry and then went to the University of Washington for ten years. In 1951, Dr. Kobe was in Rio de Janeiro to assist Conselho Nacional do Petroleo set up a graduate school for training Brazilian engineers in petroleum refining. He is the author of two books and over 175 technical articles.

Leo J. Hirth is a New Yorker who adopted Texas. He spent three years in the Army after graduation from the College of the City of New York in 1944 with a B.S. in Ch. E. His graduate work was done at Texas U., where he won an M.S. in 1949. As a research engineer for Magnolia at Dallas, 1949 to 1952, Mr. Hith engaged in studies of P-V-T behavior of hydrocarbon gas-oil mixtures, and relative permeability studies.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp., Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Cyanoethylated Cotton

Cyanoethylated Cotton, a product which represents a merger between a petrochemical, acrylonitrile, and an agricultural material, cotton, is today exciting considerable interest as a challenge to the true synthetic fibers. Cyanoethylation, pronounced **"sigh**-ah-no-**ehth**-ih-**lay**-shun," yields a product which is far cheaper than the synthetics, yet comparable in many properties.

The chemical treating of cotton with acrylonitrile, still in the pilot-plant stage, is said to yield a completely "new family of textile fibers." They are reported to be permanently resistant to mildew and bacteria and to have higher abrasion resistance, greater strength and elasticity, better receptivity to all dyes, and higher heat resistance. These improvements are said to be attainable without damage to cotton's other physical properties.

Acrylonitrile, the petrochemical industry's stake in this product, is itself the basic raw material for some of the more important synthetic fibers. Defined in the May, 1953, issue of this series, it is produced commercially from ethylene or acetylene, which in turn are produced by the pyrolysis of petroleum fractions or natural gas. Commercial output is increasing rapidly for use in synthetic fibers, soil conditioners, and synthetic rubber, but another market would probably be welcome.

Even if cyanoethylated cotton revolutionizes the textile field, something which no one dares predict, it will be but another step forward from the former acceptance of nature's products just as they are found. In this transition from the natural to the synthetic and semi-synthetic, petrochemicals such as acrylonitrile are blazing a well-defined path.

Isophthalic Acid

Isophthalic Acid, pronounced **"eye**-so-**thahl**-ick" acid, is another of the xylene derivatives which are making these petroleum aromatics of growing petrochemical importance. It has the formula $C_6H_4(COOH)_2$, and differs from the well known "phthalic acid" and the more-recently-commercial "terephthalic acid" by being the *meta* benzene dicarboxylic acid instead of the *ortho* or *para* acids; i.e., its acid groups are attached to carbon atoms on the benzene ring which are separated by only one carbon atom, whereas the *ortho* acid's groups are attached to adjacent carbon atoms and the *para* acid's groups are separated by two carbon atoms.

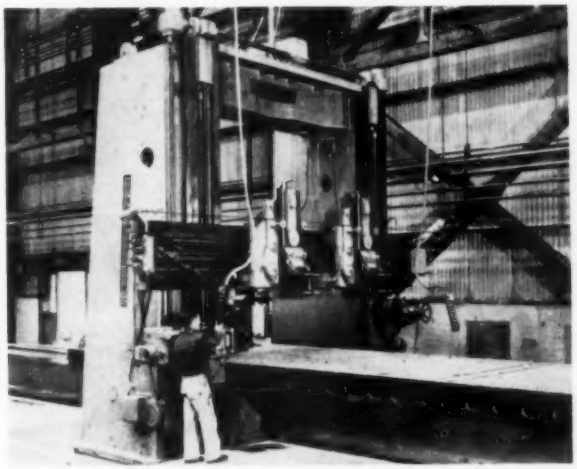
Just as phthalic (acid) anhydride is today being produced commercially in growing quantities by the oxidation of *ortho*-xylene, and terephthalic acid by the oxidation of *para*-xylene, so isophthalic acid will soon be produced in large quantities by the oxidation of *meta*-xylene. To meet the growing demands, these xylenes are today being separated in increasing quantities from the aromatic-hydrocarbon fractions produced in the catalytic reforming of petroleum naphthas. They are also obtained commercially from coal tar, their original source.

Isophthalic acid is of great potential interest to the producers of alkyd and polyester resins and plasticizers. It is expected to be a direct competitor to its established chemical brother, phthalic anhydride, in surface coatings and laminating resins, and like terephthalic acid is expected to have applications of its own.

For its initial commercial producer, at least, isophthalic acid will provide a profitable outlet for *meta*-xylene to add to its markets for the other two xylenes —phthalic anhydride from *ortho* and the sale of the *para* isomer to the producers of terephthalic acid for films and synthetic fibers. In this way it strengthens the role of catalytic reforming as a producer of profitable petrochemical by-products.

NEWS in VIEWS

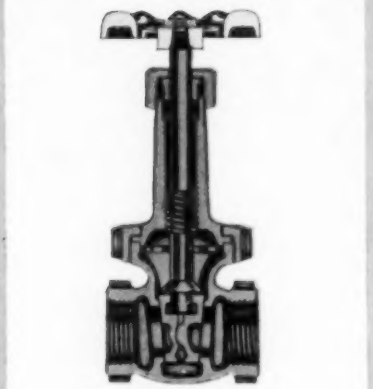
NEW FABRICATION PLANT just completed by Foster Wheeler at Mountaintop, Pa., will specialize in large pressure vessels. Main bay is 800 feet. long, 75 ft. high, 90 ft. wide; has four cranes, up to 150-ton size.



HUGE PLANING MACHINE at Mountaintop plant has a table area of 44 ft., an overall bed length of 92 ft., and width between the double housings of 122½ in. New plant will handle plate up to 8 in. thick.

Oh, I see

Solid wedge, inside screw, rising stem



Split wedge, inside screw, rising stem

Solid wedge, non-rising stem

. . . we've added 125 and 150 lb. bronze gate valves to our union bonnet line

WORKING PRESSURES
125 lb. W. S. P. 400° F.
150 lb. W. S. P. 400° F.

Success of our 200 lb. line of union bonnet bronze gate valves necessitates expansion of the line to include 125 lb. and 150 lb. classes. Sizes range from ¼ to 2 inches.

NOTE THESE ENGINEERING FEATURES:

This line has a flat seat on the bonnet which mates against the body, providing adequate bearing area for sealing.

Tight bonnet joint, but easy access to interior for inspection and service.

Full ports permit unobstructed flow.

Back-seating arrangement permits repacking while under pressure.

Split wedge has ball in socket contact . . . permits wedge to adjust itself to seat.

Slip-on type "T" head stem-to-wedge connection.

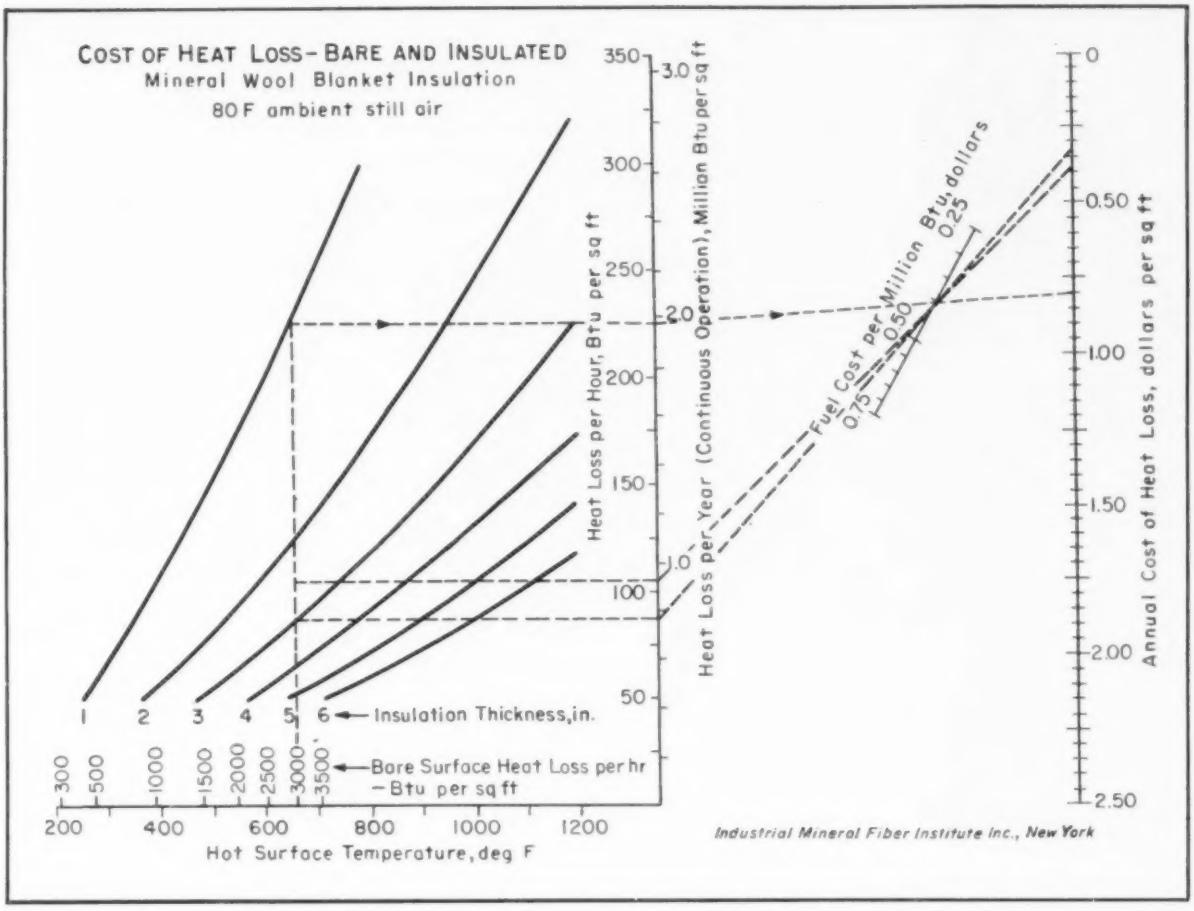
Lug-type hexes make valves compact and provide a better wrench-gripping surface.

To learn more about this expanding line of valves, write for our *Union Bonnet Bronze Gate Valve Catalog Folder.*

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC
FOUNDED 1883

VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON**


COST OF HEAT LOSS – BARE AND INSULATED
Mineral Wool Blanket Insulation
80 F ambient still air
Heat Loss per Hour, Btu per sq ft
Heat Loss per Year (Continuous Operation), Million Btu per sq ft
Annual Cost of Heat Loss, dollars per sq ft
Fuel Cost per Million Btu, dollars
0.25
0.50
0.75
Insulation Thickness, in.
Bare Surface Heat Loss per hr – Btu per sq ft
Hot Surface Temperature, deg F
Industrial Mineral Fiber Institute Inc., New York

Graph Aid in Specifying Insulation

DETERMINATION of the thickness requirements for thermal insulation can be either very easy or very difficult. Standard thicknesses for various operating temperatures might be adopted on a company-wide basis, avoiding the need to reconsider specifications on each new job.

On the other hand, the cost of insulating materials and installation might be weighed against the cost of heat loss to obtain the most economical insulation thickness under expected operating conditions.

Standard thicknesses are usually found satisfactory when the cost of heat in a new installation is about equal to that on which the standards are based. However, when the cost of heat is unusually high or low, or when the job is particularly large, a closer investigation of the most economical insulation thickness is certainly justified by the resulting savings in fuel dollars.

The heat-loss graph shown above has been designed to help the engineer in determining the most economical thickness of mineral wool blanket insulation without requiring reference tables or repeated calculations. Hot-surface temperature and fuel cost/million Btu are fixed by the application. The required data on materials and installation costs are obtained from insulation contractors or manufacturers.

To use this graph: start at the hot-surface temperature on the scale at the lower left and proceed vertically to the given insulation thickness on the curves at the left. A horizontal line through this point intersects the vertical scale in the center at both heat loss/hr. in Btu/sq. ft. and heat loss/year in million Btu/sq. ft. for continuous operation (annual heat loss may be adjusted proportionately when operation is not continuous). Follow with a line through heat loss on the center scale and through cost/million Btu on the slanted scale to meet the right hand scale at the approximate annual cost of heat loss in $/sq. ft.

For each particular insulating job hot-surface temperature and the cost of heat are constant, so that insulation thickness only can be varied (presuming the type of insulation and finish remains the same). The engineer then selects two or three reasonable insulation thicknesses and determines with the graph the corresponding annual

Problem

To produce more ammonia without excessive expansion of existing facilities.

Solution

GIRDLER helped solve this problem by developing two highly active catalysts, G-19 and G-3. Without sacrificing quality or enlarging the gas plant, the use of these two GIRDLER Catalysts on synthesis gas production resulted in:

75% more output

Girdler specializes in solving catalyst problems. Its knowhow is at *your* service.

FOR

Catalysts

WRITE...

The GIRDLER Company

A DIVISION OF
NATIONAL CYLINDER GAS COMPANY
Gas Processes Division
LOUISVILLE 1, KENTUCKY
NEW YORK • TULSA • SAN FRANCISCO

Table 1—Cost Comparisons

Insul. thick inches	Heat loss annual cost $/sq.ft.*	Heat savings over 1-in. thickness annual $/sq.ft.	Total material & installation cost (approx) over 1-in. thickness $/sq.ft.
1	0.80	...	...
2½	0.38	0.42	0.25
3	0.33	0.47	0.40

* From graph.

cost of heat loss in each circumstance.

Knowing the difference in total installation cost between the various thicknesses, the specific operating cycle, and the company's depreciation rate, the engineer can obtain the most economical insulation thickness. If desired, of course, the graph can be used to determine heat loss alone, from both bare and insulated surfaces.

Assume the following problem: the determination of the most economical insulation thickness for a heated vessel operating continuously at 660° F. and at a fuel cost of $0.40/million Btu.

Applying the graph (as shown by the dotted lines), an engineer obtains and tabulates the heat-loss costs for tentative insulation thicknesses of 1, 2½, and 3 in. He then tabulates the *added* cost (materials and labor) to provide 2½ or 3 in. as compared to 1 in. Thus, it is assumed in the table that 2½-in.-thick insulation costs $0.25 more per sq. ft. when installed than does 1-in.-thick mineral wool blankets. (See Table 1.)

It is evident that 2½ in. is a more economical thickness than 1-in., since heat savings per sq. ft. are $0.17 greater in the first year than the total added installation cost.

A thickness increase to 3 in. saves $0.05 more per sq. ft., but costs $0.15 more to install than 2½-in. The added ½ in. of insulation would take three years to pay for itself at the assumed fuel cost of $0.40/million Btu. Thus, selection of insulation thickness would in this case be governed by anticipated life of the vessel.

Using the bare-surface heat-loss scale at the lower left of the graph, it is evident that the bare loss at 660° F. is about 3000 Btu/sq. ft./hr. (at 80° F. ambient)—at a cost of about $10.50/sq. ft./yr.

Heat loss in plotting the graph is given by the following expression:

$$U = (t - 80)/(x/k + 1/c) \quad ..(1)$$

where: U = Btu/hr./sq. ft.

t = hot-surface temperature, °F.

80 = assumed constant ambient temperature.

x = insulation thickness, inches.

k = thermal conductivity of insulation, Btu/hr./sq. ft./in./°F.

c = surface conductance factor, assumed constant at a typical value of 2.

Thermal conductivity is given by (in Btu/hr./sq ft./in./°F.):

$$k = 0.252 + 0.00035t \quad .....(2)$$

This represents typical design values for mineral wool blanket insulation at mean temperatures from 100 to 600° F. Temperature of the outside insulation surface is assumed at 120° F. in converting mean temperature to hot-surface temperature in Equation (2).

Because of the several assumptions made, the graph cannot be expected to be more accurate than ±15%, although most results (with reasonable thickness of insulation) will be quite close to actual values. When the graph is used on a comparative basis, much of the error is cancelled out.

Industrial Mineral Fiber Institute, Inc.

Tips on Ball Bearing Maintenance

AN important part in the service life of an electric motor or a pump is played by shaft bearings. Proper fit, installation, and lubrication are all important factors in obtaining good service.

Following is a continuation of a series of questions and answers started a few months ago dealing with this problem. They were a portion of a seminar on the subject conducted at the Aruba, Netherlands West Indies, refinery of Lago Oil & Transport Co. by Mr. Jack Cannon, Continental Electric Co., and made available to PETROLEUM PROCESSING by Lago.

The problem of substitution is covered in this month's set of questions and answers:

How can you replace a double row ball bearing with a single row deep groove ball bearing?

 (To obtain more data on advertised products see page 128)

Most of the double row ball bearings at Aruba are on pumps and on the out-board end, which "floats." Select a single row deep groove ball bearing with the same O.D. and I.D. and make a spacer for the shaft that will take up the difference between the greater width of the double row ball bearing and the lesser width of the single row bearing.

The I.D. of the spacer, which can be made from a steel tube, should be a light, push-fit on the shaft. The O.D. of the spacer should be about the same as the diameter of the shoulder of the shaft. The length is not too critical. But it should be within 1/32 in. of the difference between widths. Each end of the spacer must be square and parallel with the other. You mount the spacer on the shaft first and then the single row deep groove ball bearing.

If a piece of equipment originally used a pair of matched angular contact ball bearings arranged D.B. (which means back to back), how can we be sure that we can substitute a single row deep groove bearing of the same size with the proper spacers for outer and inner races?

Prior to 1948, the ball bearing handbooks showed certain thrust values for angular contract bearings. At that time, the thrust capacity of single row deep groove bearings was not as high.

Since 1948, the radial and thrust capacities of single row deep groove bearings have increased to the point where they are practically equal to the old angular contact ratings. Therefore, it is safe to make this substitution.

The final answer, however, will be the actual performance that will result if you make the substitution. Remember that all you can ask of a bearing is that it runs. If you have been having trouble with angular contact bearings arranged D.B. and you substitute a single row deep groove bearing with spacers and get longer life, then you have the answer.

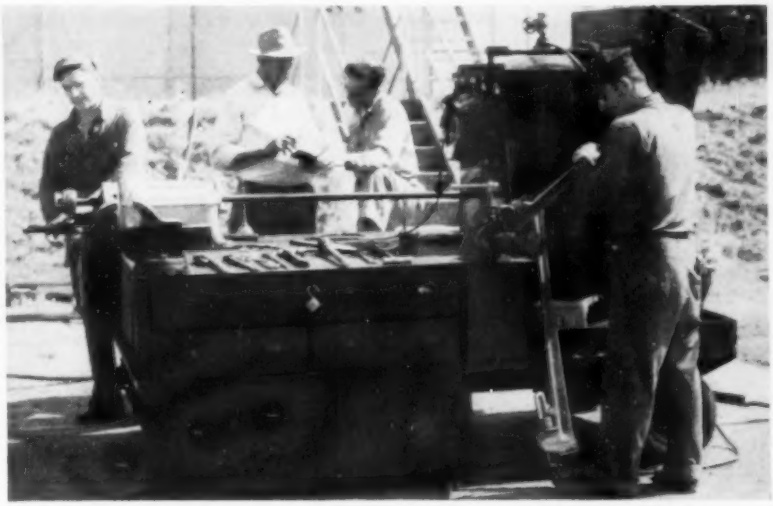
Can you substitute a single row deep groove ball bearing for a pair of matched angular contact bearings?

Yes, provided the matched duplex bearings are arranged D.B., that is, back to back. Suitable spacers are available if you will press the balls and inner race out of one of the angular contact bearings which you took out of the job. Install this inner race on the shaft first as a spacer and then the outer race in the housing as a spacer. Then mount the single row deep groove bearing on the shaft. The spacers in effect bring the shoulder on the shaft and the shoulder of the housing to a new position which makes the dimensions proper for a single row deep groove bearing.

The new ratings of the single row bearings are as much as the old ratings of the angular contact bearings arranged D.B. Further, you now can properly lubricate the one ball bearing, which was not practical when you had a pair of matched bearings.

Can you substitute two single row deep groove ball bearings for a pair of matched duplex bearings?

No. Single row deep groove ball bearings are not matched and the widths of the inner and outer races can vary as much as 0.003 in. You can substitute one single row bearing with proper spacers for a pair of matched duplex bearings arranged D.B.



Trailer Speeds Up Tank Maintenance

UPKEEP of storage tanks is one of the bigger maintenance problems in today's sprawling refineries and petrochemical plants. It's a problem mainly of cutting down travel time and unwanted, non-productive man-hours involved in getting from the shops to various tank farm areas.

Clinton C. Howe, an employe of Monsanto Chemical Co.'s Plastics Division at Springfield, Mass., has come up with an idea to beat this problem which has application in any plant with far-flung tank areas.

With the help of co-workers, he developed and built a workshop on wheels, a mobile maintenance unit from which as many as six men can service the tanks at one time.

As for cost-cutting, Howe's unit has enabled Monsanto maintenance crews to wrap up several of their jobs in half the time they used to take.

The unit, virtually a "field annex" for the central shops, is a trailer 8 ft. long and 4 ft. wide. It weighs about one ton and is shuttled about between jobs by means of a jeep. The trailer is equipped with a long extension cord which plugs into any 550-volt outlet in the plant. This converts the trailer to a small electrical distribution station.

Equipment on the trailer includes a high-capacity pump for cleaning out tanks and for emergency pumping jobs; a pipe-threading machine; two vises; and a variety of small power tools which are fed by a single 550-volt line to eliminate a network of tangled extension cords.

There are also two 110-volt outlets for extension lights; as well as a supply of large pipe wrenches, non-sparking tools, and common pipe fittings.

Except for the wheels, tires, and attached power equipment, the trailer was built entirely from scrap. Consequently, labor was the biggest single cost item in its construction.

The unit replaced a previous method of handling tank farm service by men working out of the central shop. Trips between shop and job in the field were too frequent. Although the procedure for servicing tanks has not been changed, the mobile shop eliminates much wasted travel time.

Naphtachimie

in production with new SD *process*

First

in Europe with Commercial

ETHYLENE OXIDE

by Direct Oxidation

Climaxing 7 years of development, SD's new direct oxidation process for producing ethylene oxide at low cost has now reached successful initial operation . . . at Naphtachimie's new L'Avera plant near Marseille, France, also designed by SD. Naphtachimie is not only first in Europe, but first new producer in the world since 1938 to use such a process. And performance to date, they report, has actually exceeded design specifications. You, too, will profit by utilizing SD's specialized experience in organic chemical plant design. Their services are available to you, on a confidential basis, on any problem involving a process of your own, or one to be procured or developed.

SCIENTIFIC DESIGN COMPANY, INC.

EXECUTIVE OFFICES: 2 PARK AVE., NEW YORK 16, N. Y.

Engineering Offices: Jersey City, New Jersey

(To obtain more data on advertised products see page 128)

How Infrared Aids the Small Refiner

By PAUL T. BUCHANAN*
Panoma Corp.

THE small refiner or natural gasoline plant operator may find infra-red analysis an economic advantage to his plant laboratory.

Cost per analysis by infra-red has been considerably less than that of analysis by fractional distillation methods in the Panoma Corp. plant at White Deer, Texas. Even the instrumental maintenance costs have been much lower.

Through-put at the plant is approximately 110 million cubic feet of natural gas per 24 hour day. Our refined products include propane, isobutane, normal propane, isopentane, normal pentane, and automotive gasoline. We have had an infra-red spectrometer in service for more than two years and we are thoroughly convinced of its usefulness.

Compared to standard laboratory methods we have found an infra-red spectrometer more accurate and a considerable timesaver. Our main applications are analyses in conjunction with refinery control tests and to determine purity of hydrocarbon products.

The initial installation cost in June. 1951, (not including labor) was $5923.32. Since then we have spent $409.84 on maintenance materials. With the assistance of a trained spectroscopist, the infra-red spectrometer was set into operation in less than one and one-half days after the necessary materials and accessory equipment were available.

About 90% of our analyses is on three-component mixtures, the remaining 10% is on two and four-component mixtures. We have found that after the proper infra-red measurements have been made concentrations may be easily determined by simple algebraic methods and slide rule calculations.

Time per analysis is one-tenth that of our previous method—fractional distillation.

A reduction in laboratory personnel of 50% has also been accomplished. Furthermore the laboratory technician has ample time to obtain the hydrocarbon samples that he is to analyze as well as to carry out other refinery operation assignments.

Analyses made on the instrument serve as checks on the hydrocarbon generally sold by our type of plant. Composition of natural gasoline blends such as 18, 20, 22, and 24 psig products can be determined, and from the analysis the vapor pressure and specific gravities can be calculated. This method provides a quick and accurate substitute for the Reid and LPG vapor pressure method and the API gravity method. Although the method is not an acceptable substitute as yet for the ASTM method there is a possibility that it will become so as usage grows.

Infra-red analysis has been instrumental in improving operating efficiency—by conducting routine infra-red analyses in the laboratory in conjunction with tests by plant operating personnel.

For example: the analyst and plant operator take samples at the same time from a fractionating column. While the operators are running weathering or boil-away tests, the analyst is carrying out an infra-red analysis. When results of the analysis are tabulated and compared with the results obtained from the initial and final boiling point determined from the weathering and boil-away tests, the operator is able to see more clearly how efficiently the fractionator is operating and just what his operating objectives are. These joint tests also serve to encourage the operator to maintain high operating standards.

With the aid of detailed analyses made on the infra-red spectrometer tabulated charts have been devised for use with the weathering and boil-away tests. From the charts, the operator can determine the end point he should obtain from such tests at atmospheric pressure and so control purity.

The infra-red technique is especially efficient and useful when it is desired to analyze a large number of samples as quickly as possible.

This situation is encountered when it is necessary to determine the temperature gradient through a fractionation column. Through information obtained quickly by infra-red analysis, it is possible to locate the proper tray on which to insert a temperature controller.

* Mr. Buchanan is chief chemist at the Cargray Plant, Panoma Corp., White Deer, Texas. This article was made available by *Instrument News*, The Perkin-Elmer Corp., Norwalk, Conn.

Two Ways to More Accurate Analyses

ONE of the basic factors affecting the accuracy of analysis by low temperature fractional distillation is the accuracy of calibration of the volumes used in the receiver system.

Several methods have been used to determine the receiver volumes. The greatest ease of reproducibility and probably the greatest accuracy is obtained when the volume is determined from the weight of water required to fill the receivers.

There is one precaution to be observed with this method, however. For the greatest accuracy it is necessary to consider the buoyancy effect of air upon the water being weighed. For a one-gal. receiver, the buoyancy correction is approximately 4.5 gm., or over 0.1% of the total volume. Hence, this is a significant correction. The volume of the manifold leading to the bottles is most conveniently determined with a gas burette. This will be the preferred method in the new instruction manual on low temperature fractional analysis being prepared by the Natural Gasoline Association of America, but several alternate methods are also to be included.

Another factor is manometer error. This sometimes causes inaccuracies in distillation analyses from neglect of the effect of temperature on mercury density.

One atmosphere of pressure, or 14.696 psi., is equal to the pressure exerted by a column of mercury 76 cm. high, only when that mercury column is at 0° C. Consequently, in order to obtain true pressure unit readings from a mercury manometer, corrections must be made for the variation of mercury density with temperature.

Assuming a normal room temperature of around 75° F., the correction factor to the observed reading of a mercury manometer is 0.9957. When the entire analysis is completed in the distillation column, the units of pressure are unimportant because they will all be on the same relative basis.

However, if there is a liquid residue from the distillation, absolute pressure units are required to combine the residue with the distillate in computing the complete analysis.

NOTE: the preceding information was obtained from the paper, "Low Temperature Fractional Analysis and the NGAA School," presented by J. F. Wilson, research engineer, Union Oil Co. of California, Brea, Calif., at the 28th annual fall meeting of the California Natural Gasoline Association, Los Angeles, Oct. 8-9, 1953.

Now

a highly soluble

BRONZE

GASOLINE DYE

to simplify your operations

The mixing of several gasoline dyes to obtain a desired color has long been an inconvenience to refiners.

If you have had this problem in creating a bronze color, it is now easy to simplify your dye addition operations.

Du Pont Oil Bronze makes this possible. The new Du Pont bronze dye is a free-flowing powder that can be easily handled in dry eductor systems as well as in any other commercial method of gasoline dye addition.

Highly Soluble—Oil Bronze has a total solubility in synthetic gasoline of 4500 grams of dye per 100 U.S. gallons. This is in the normal range of solubility of other gasoline colors, and speed of solution is also fast.

This new bronze dye is ready for shipment in standard 100-pound containers . . . also in 50-pound, 25-pound and smaller size packages.

Samples and full details on Du Pont Oil Bronze are available from any Du Pont Petroleum Chemicals Division representative or district office.

PHYSICAL PROPERTIES OF DU PONT OIL BRONZE DYE:

Physical Appearance	Brownish, red powder
Max. Absorption Wave Length, Millimicrons	465-470
Melting Point, °F.	225
Approx. Bulk Density, Lbs./Gal.	1.8
Water Extractability Loss in Strength	
Distilled Water	Nil
Sea Water	Nil
0.1 N-Caustic	Nil

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

District Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas . . . Phone COlumbus 5-3620
CHICAGO, ILL.—8 So. Michigan Blvd. . . . . Phone RAndolph 6-8630
TULSA, OKLA.—1811 So. Baltimore Avenue . . . . . Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. . . . . Phone PReston 2857
LOS ANGELES, CALIF.—612 So. Flower St. . . . . Phone MAdison 1691

IN CANADA: Canadian Industries Limited—Toronto, Ont.—Montreal, Que.—Calgary, Alta.
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

By Peter J. Gaylor, Patent Attorney, Newark, N. J.

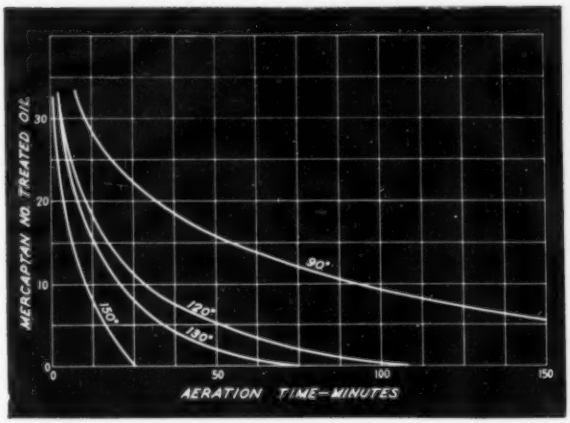


FIG. 1—Effect of temperature on rate of mercaptan removal

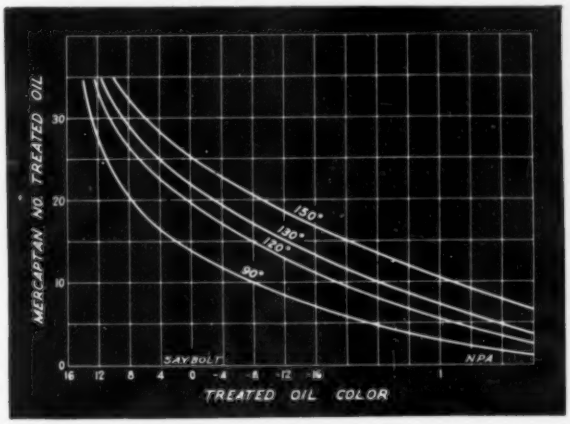


FIG. 2—Effect of temperature on color formation

Potassium Hydroxide Solution Shown Useful for Sweetening Distillates

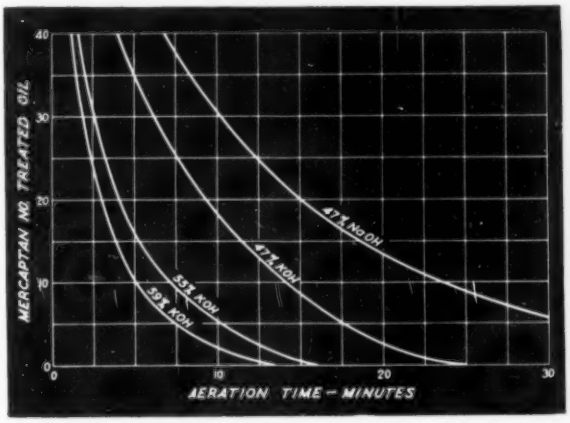


FIG. 3—Comparison of potassium hydroxide with sodium hydroxide treating solutions

CAUSTIC soda of about 10-20% aqueous concentration is the usual reagent used for removing mercaptans from sour distillates. This reagent is not very effective for higher molecular weight mercaptans, so that solutizers have been added to the caustic to increase mercaptan solubility.

Anhydrous caustic in methanol also has been tried, but serious color formation is claimed to have been encountered, especially when treatment was conducted at 150° F and above. Air necessarily had to be excluded in order to keep color down.

In U. S. Patent 2,645,602, Standard Oil Co. (Indiana) describes a sweetening process employing air oxidation in presence of aqueous KOH solutions. The process is particularly adapted to treating hydrocarbons boiling above gasoline, with 50-60% aqueous KOH and air blowing at 100-125° F, with minimum color degradation or formation of oil-soluble color bodies. The refined oil is claimed to have satisfactory burning characteristics when employed in sleeve-type burners.

The amount of oxygen (as air, etc.) required is 1½ to 2 times the amount required theoretically to convert the mercaptans to disulfides. The effect of temperature upon the rate of mercaptan removal is shown in Fig. 1. The tests were conducted on West Texas heater oil having a Saybolt color of +15 and a mercaptan number of 58. The sample was contacted with 1 vol.—% of 55% aqueous KOH and 4.85 cu. ft. of air per hour. The lowest temperature employable in practice is about 100° F.

The effect of temperature on color formation is depicted in Fig. 2. Higher temperatures increase color apparently due to oxidation of phenolic substances contained in the high sulfur oils. In order to obtain a treated oil of about 5 mercaptan number with a color of about 1 NPA, the reaction temperature must be held below about 125° F.

Fig. 3 illustrates the superior action of KOH over NaOH solutions. To reduce mercaptan number from 70 to 5, aeration time of 32 minutes was necessary with 47% NaOH and only 18 minutes with 47% KOH. The graphs also show the effect of concentration on rate of mercaptan oxidation. There is a tendency for the oxidation to slow down as lower mercaptan numbers are reached, and the rate decreases most markedly with the lower KOH concentrations.

The KOH solution also separates

more readily from the oil, whereas NaOH tends to emulsify. The process particularly is advantageous for treating cracked stocks.

Sulfuryl Chloride Yields Color Stability, Sweet Oil

PETROLEUM distillates used for burning oils, diesel oils, heater oils and heavy kerosines are much more difficult to sweeten than are naphthas. This is particularly true when the raw distillate comes from a high sulfur crude such as West Texas or California. A virgin distillate containing objectionable amounts of mercaptans is extremely difficult to sweeten without seriously affecting the color stability of the product oil. This is particularly true of sulfuric acid treating. In U. S. Patent 2,651,596 (Standard Oil Co., Ind.) a method is described for treating virgin petroleum distillates containing objectional amounts of mercaptans to produce a substantially sweet product oil having good color stability. A mixture of sulfuric acid and sulfuryl chloride is used in the treatment, followed by an aqueous caustic wash.

A still further improved oil with respect to color stability can be obtained by a two-stage treatment comprising, first, contacting of the sour distillate with sulfuryl chloride and sulfuric acid, separating the treated oil from the acid sludge, and, second, contacting the treated oil with sulfuric acid and separating the oil from the sludge, after which the oil is washed.

The sulfuric acid preferably is of 93-100% strength and can be fresh acid or black acid. The amount of acid used in the one-step process is 4-10 lb. per barrel of sour distillate treated. In the two-step process, 2-10 lb. per barrel are used in the first step, and the same amount in the second step. The amount of sulfuryl chloride is 0.05-1 wt. %, based on the sour distillates charged. When using 4-10 lb. per barrel acid, the amount of SO_2Cl_2 is between 0.2-0.5%. Sulfuryl chloride is a liquid of 1.667 sp. gr., with a boiling point of 156° F. It is generally added with the mixture of sulfuric acid and distillate. Treating temperature is between 80-100° F. and treating time between 5-30 min.

Tests are submitted on the treatment of a West Texas heater oil having a mercaptan number of 70 and original color 21 saybolt, aged color 12 saybolt. With a two-step treatment, in which the sour distillate is contacted for 10 min. at 90° F with 4 lb. per barrel of black 98% acid, and SO_2Cl_2 in an amount of 0.21 wt. %, based on the oil, and, the second stage, contacting with 4 lb. of black 98% acid, followed by neutralization and water washing. The oil obtained was mercaptan sweet, had an original color of 30 and aged color of 29, and it contained only 0.02% chlorine.

To show that free chlorine and sulfuric acid will not give such results, data are submitted indicating that, in order to obtain both a sweet and a color stable product, it is necessary to use an enormous amount of acid along with the free chlorine.

Patents Issued in November

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for November 3, 10, 17, and 24, 1953, Vol. 676, Nos. 1-4.

PROCESSES

Refining

2,657,761 (Phillips Petroleum Co.) Method of separating ethane from hydrocarbon mixtures with a perfluoroamine selective solvent.
2,657,917 (Robert E. Stanton) Method of high-temperature treatment of compounds with ceramic pebbles.
2,657,982 (Ethyl Corp.) Synergistic antioxidant composition (alkyl-p-phenylene diamine with alkyl mercaptan).
2,657,983 (Ethyl Corp.) Synergistic stabilizing compositions (thioglycolate and aminophenol).
2,658,027 (Air Reduction Co., Inc.) Neutralization of acid constituents in petroleum in vapor phase in presence of soap.
2,658,060 (The Texas Co.) Process for centrifugal separation of urea complexes from organic mixtures.
2,658,853 (The Atlantic Refining Co.) Solvent fractionation of wax-containing mixtures, using anhyd. phenol.
2,658,854 (Socony-Vacuum Oil Co.) Gravity dewaxing of wax-bearing hydrocarbon fractions, using polyhydroxy alcohol.
2,658,855 (Socony-Vacuum Oil Co.) Deoiling wax, using absorbent belt.
2,658,856 (Standard Oil Development Co.) Process of refining and stabilizing waxes, using Mo-alumina catalyst.
2,658,863 (Gulf Oil Corp.) Process and apparatus for increasing vacuum tower production.
2,658,887 (The Texas Co.) Process for forming urea-hydrocarbon complexes.
2,659,453 (Phillips Petroleum Co.) Separation of acetylene from gaseous mixtures by glycolonitrile.
2,659,664 (William Robert Works and Frank A. M. Buck) Vortex ring process for liquid-liquid extraction.
2,659,691 (Societe Anonyme dite Compagnie Francaise de Raffinage, France) Process for refining petroleum products by oxidizing mercaptans in presence of chelate compounds.
2,660,262 (Standard Oil Development Co.) Adsorption-desorption process (reactivation with hot combustion gases).
2,660,514 (Frederick A. Rohrman) Removal of nitrogen from mixtures of combustible gases, using lithium to form nitride.
2,660,516 (Standard Oil Development Co.) Sulfuric acid recovery from dilute ethylene extract by adding pine oil as carbon flocculant.
2,660,600 (Standard Oil Co.) Removal of oxygenated organic compounds from hydrocarbon mixtures thereof by contacting over oxide of alkaline earth metal.

Catalysts

2,657,978 (Kaiser Aluminum & Chemical Corp.) Alumina hydrate crystallization.
2,658,028 (Universal Oil Products Co.) Manufacture and use of alumina-platinum catalysts.
2,658,041 (Sinclair Refining Co.) Cobalt magnesia-kieselguhr catalyst.
2,658,860 (Standard Oil Development Co.) Separation of contaminated catalyst particles in hydrocarbon conversion process, using centrifugal action.
2,658,875 (Shell Development Co.) Nickel catalyst and preparation thereof.
2,659,660 (Societe d'Electro-Chimie d'Electro-Metallurgie et des Acieries Electriques d'Ugine, France) Method and apparatus for the manufacture of alumina.
2,660,564 (Monsanto Chemical Co.) Method of reducing the density of aerogels and similar materials.

Conversions

2,657,501 (Phillips Petroleum Co.) Method for gasifying coal.
2,658,031 (The Lummus Co.) Coking appartus.
2,658,059 (Standard Oil Co.) Ethylene polymerization to grease-like polymers in the vapor phase, using Ni-Co catalyst.
2,658,061 (U.S.A. Secretary of Interior & California Research Corp.) Apparatus for the retorting of oil shale and similar materials.
2,658,822 (Standard Oil Co.) Fluidized solids system.
2,658,858 (Socony-Vacuum Oil Co.) Aromatization reforming and catalysts for effecting the same (Cr-Fe).
2,658,859 (Houdry Process Corp.) Catalytic conversion of hydrocarbons in presence of hot hydratable adsorbent.
2,658,861 (The Texas Co.) Process for the hydrogenation of coal.
2,658,862 (Reilly Tar & Chemical Corp.) Process for the defluidization and fixed-bed coking of a preheated fluidized coal.
2,658,931 (Socony-Vacuum Oil Co.) Reforming catalyst and method for preparing the same (alkali metal chromicyanide).
2,659,633 (Sun Oil Co.) System for elevating contact material.
2,659,668 (Phillips Petroleum Co.) Method for gasifying coals.
2,659,692 (Universal Oil Products Co.) Catalytic reforming of hydrocarbons in two stages utilizing a platinum-aluminahalogen catalyst composite.
2,659,701 (Standard Oil Co.) Solubilized platinum sulfide reforming catalyst.
2,660,235 (Combustion Engineering, Inc.) Burner for converting natural gas into gasoline components.
2,660,520 (Standard Oil Development Co.) Apparatus for catalytic conversion of hydrocarbons using phosphoric acid catalyst.

Hydrocarbon Synthesis

2,657,986-7 (Standard Oil Development Co.) Production of water gas, using fluidized system.
2,658,906 (Stanolind Oil and Gas Co.) Removal of iron contaminants from hydrocarbon synthesis products.
2,660,521 (Texaco Development Corp.) Process for the generation of carbon monoxide and hydrogen by partial combustion in gas turbine.
2,660,598 (Hydrocarbon Research, Inc.) Catalytic synthesis of hydrocarbons.
2,660,599 (Ruhrchemie Aktiengesellschaft) Catalytic hydrogenation of carbon monoxide.

PRODUCTS

Lubricants

2,657,900 (American Cyanamid Co.) Hydrocarbon oil containing S-(sulfurized terpene hydrocarbon) dithiophosphoric acid triesters.
2,657,943 (General Electric Co.) Means for mechanically preventing oil creepage.
2,658,037 (Chemieprodukte G.m.b.H.) Manufacture of lubricating greases containing beeswax.
2,658,062 (Standard Oil Development Co.) Mineral oil additive (P-S compound).
2,658,869 (Shell Development Co.) Silica gel grease compositions.
2,658,870 (Gulf Research & Development Co.) Cutting oil composition containing solvent extract.
2,658,871 (Standard Oil Development Co.) Lubricating composition containing phosphoric ester.
2,659,694 (Standard Oil Development Co.) Lubricating oil compositions containing alkyl diphenylalkane monosulfonates.
2,659,695 (L. Sonneborn Sons, Inc.) Lubricating greases using petroleum mahogany sulfonates.
2,659,696 (Union Oil Co. of California) Lubricating oil containing a metal salt of a condensation product of an alkyl substituted phenol and an olefin oxide.

2,659,697 (Sinclair Refining Co.) Lubricating oils containing an acyloxyacetic acid as a rust inhibitor.
2,659,705 (Standard Oil Development Co.) Corrosion preventing agent (P-S compound).
2,660,309 (Bowser, Inc.) Lubricating oil conditioning apparatus.
2,660,552 (Standard Oil Development Co.) Combination process for producing lubricating oils by fractionating, solvent extracting and dewaxing cat. cracked gas oil.
2,660,562 (Phillips Petroleum Co.) Lubricants containing guanidine sulfonate.
2,660,563 (Standard Oil Development Co.) Mineral oil containing modified polymer of a multiolefin.

Chemicals

2,657,975 (Ethyl Corp.) Preparation of aluminum borohydride.
2,658,038 (Standard Oil Co.) Disulfoxides.
2,658,069 (Shell Development Co.) Separation of oxygenated compounds.
2,658,083 (Standard Oil Co.) Selective hydrogenation of oxo-process aldehydes.
2,658,085 (Arvey Corp.) Chlorination of cyclopentadiene.
2,658,087 (Chempatents, Inc.) Chlorination of olefins in dilute mixtures.
2,658,088 (Chempatents, Inc.) Chlorination of ethylene in dilute mixtures.
2,658,089 (Universal Oil Products Co.) Dehydrogenation of a gem alkyl arylcyclohexane.
2,658,090 (Ruhrchemie Aktiengesellschaft) Production of olefins by dechlorination of alkyl chlorides.
2,658,872 (Standard Oil Development Co.) Modified copolymers and preparation and uses thereof.
2,658,900 (Gulf Research & Development Co.) Sulfurization of di-isobutylene.
2,658,901 (Socony-Vacuum Oil Co.) Pinyl thiophene.
2,658,902 (Socony-Vacuum Oil Co.) Thiophene polymers.
2,658,903 (Sterling Drug Inc.) Preparation of thiophene and alkylated thiophenes.
2,658,913 (Shell Development Co.) Process for the producton of naphthalene and related derivatives, and derivatives of highly chlorinated, partially hydrogenated triphenylene.
2,658,919 (Universal Oil Products Co.) Production of ketones.
2,658,923 (Standard Oil Development Co.) Stabilized oxo alcohols.
2,658,924 (Socony-Vacuum Oil Co.) Catalytic hydration of olefins.
2,658,926 (Shell Development Co.) Chlorinated polycylic compounds.
2,658,927 (Farbenfabriken Bayer Aktiengesellshaft, Germany) Fluorination of chlorine containing derivatives of paraffin hydrocarbons.
2,658,928 (Minnesota Mining & Manufacturing Co.) Method of making fluorocarbon chlorides and bromides by thermal chlorination and bromination of fluorocarbon hydrides.
2,658,930 (Universal Oil Products Co.) Production of polyhaloalkanes.
2,658,932 (Standard Oil Development Co.) Treatment of copolymer olefins for oxonation.
2,658,933 (Standard Oil Development Co.) Slurry polymerization process.
2,659,659 (Standard Oil Development Co.) Ammonium sulfate production from sulfuric acid sludge.
2,659,714 (Shell Development Co.) Allyl-type phosphinates and polymers of the same.
2,659,746 (Celeanese Corp. of America) Oxidation of lower hydrocarbons in liquid phase with soluble bismuth catalyst.
2,659,748 (Lion Oil Co.) Process of preparing acrylonitrile from acetylene and HCN.
2,659,758 (Shell Development Co.) Maintaining activity of cuprous oxide catalyst in oxidation of olefins.
2,659,762 (Standard Oil Co.) Isodurene manufacture.
2,659,763 (California Research Corp.) Xylene separation.
2,660,517 (Ethyl Corp.) Production of sodium hydroxide and hydrogen from elemental sodium.
2,660,572 (Socony-Vacuum Oil Co., Inc.) Resinification of aromatic hydrocarbons with formaldehyde and clay.
2,660,602 (Standard Oil Development Co.) Process for preparing branched primary sulfate esters.
2,660,610 (Allied Chemical & Dye Corp.) Catalytic alkylbenzene synthesis.

Fuels

2,657,984 (Shell Development Co.) Fuel oils employing metal amino compound pour depressant.
2,657,985 (Standard Oil Development Co.) Saturated hydrocarbon fuel containing 2:4:2 rates of 2, 2, 3 TMB, 2, 2, 3, 3 TMB and 2, 2, 3, 3, 4 PMB.
2,658,349 (Aktiengesellschaft Fuer Technische Studien) Plant for the recovery of waste heat from combustible gases derived from chemical processes.
2,658,360 (The Chemical Foundation, Inc.) Transportation of natural gas.
2,658,823 (Socony-Vacuum Oil Co.) Fuel oil composition containing tall oil salt as sludge inhibitor.
2,659,201 (Phillips Petroleum Co.) Gas turbine combustion chamber with provision for turbulent mixing of air and fuel.
2,659,666 (Standard Oil Development Co.) Triphenyl carbinol stabilizer for residual oils.
2,660,032 (Henry Rosenthal) Gas turbine cycle employing secondary fuel as a coolant.
2,660,591-6 (Ethyl Corp.) Lead alkyl compositions thermally stabilized with azobenzene, etc.

Specialties

2,658,017 (Phillips Petroleum Co.) Insecticidal compositions containing 1,2-dichloro-4(a,B-dichloroethyl)-cyclohexane and method of using the same.
2,658,026 (Standard Oil Co.) Asphaltic materials and the method of preparing the same (positive spot test to negative).
2,658,817 (Shell Development Co.) Corrosion inhibitor (starch and chromic acid).
2,658,852 (Standard Oil Development Co.) Method of manufacturing low melting point plastic waxes from foots oil.
2,658,857 (Standard Oil Development Co.) Bituminous saturant obtained by thermal cracking of catalytic cycle oil.
2,659,683 (Shell Development Co.) Method of preparing high-glaze waxed paper by passing through molten paraffin wax.
2,659,693 (Standard Oil Development Co.) Process for preventing corrosion of ferrous metals using long chain quaternary ammonium salt in the corrosive solution.
2,659,699 (Lockheed Aircraft Corp.) Hydraulic fluid of polyhydric alcohol and trialkyl phosphate.
2,660,553 (Standard Oil Development Co.) Wax composition and process for producing hard flexible wax from cat. cracked stock.

Miscellaneous

2,657,506 (Sun Oil Co.) Pipeline cleaning and polishing device.
2,657,753 (Phillips Petroleum Co.) Tool for impinging liquid against inner walls of chambers.
2,658,728 (The Lummus Co.) Method of detecting leakage between heat transfer fluids.
2,659,452 (Universal Oil Products Co.) Condensate trap.
2,660,059 (Phillips Petroleum Co.) Liquid level measuring apparatus employing magnetizable float.
2,660,544 (Sinclair Refining Co.) Cleaning spark plugs with ammonium citrate, etc
2,660,590 (The M. W. Kellogg Co.) Solvent fractionation of fatty materials.
2,660,601 (The M. W. Kellogg Co.) Separation of fatty acids from hydrocarbon solutions thereof.

EQUIPMENT

Processing, general

2,657,473 (Kaiser Aluminum & Chemical Corp.) Apparatus for effecting indirect heat exchange with finely divided solids.
2,657,760 (National Tank Co.) Horizontal fluid separator.
2,657,803 (Lummus Co.) Centrifugal filter apparatus.
2,658,025 (Shropshire-O'Neill Tank Co.) Oil-treating apparatus having a settling tank heating means.
2,658,031 (Lummus Co.) Coking apparatus.
2,658,061 (U.S.A. and California Research Corp.) Retort for the destructive distillation of oil shale and similar solid materials.
2,658,349 (Aktiengesellschaft Fuer Technische Studien) Plant for the recovery of waste heat from combustible gases derived from chemical processes.
2,658,644 (Proportioneers, Inc.) Apparatus for proportioning materials.
2,658,729 (Saul Horwitz) Preheater-type heat exchanger.
2,658,737 (Irvin E. Nutter) Means for flow control in bubble towers.
2,658,738 (Gilbert & Barker Mfg. Co.) Holding device for bubble caps.
2,658,821 (Herman L. Ammann) Chamber reactor for the production of carbon black.
2,658,863 (Gulf Oil Corp.) Process and apparatus for increasing vacuum tower production.
2,659,209 (Warren Petroleum Corp.) Underground liquid storage facility and method of selecting and preparing same.
2,659,450 (Fluor Corp.) Pulsation eliminator and gas cleaner.
2,659,451 (Fluor Corp.) Centrifugal gas cleaner.
2,660,235 (Combustion Engineering, Inc.) Burner for converting natural gas into gasoline components.
2,660,259 (Morehouse Industries) Apparatus for de-aerating a product such as grease or the like.
2,660,519 (Chemical Construction Corp., Fluid heater.

Instruments

2,657,572 (James D. Fann) Device for measuring flow properties of fluids.
2,657,577 (Askania-Werke Aktiengesellschaft) An apparatus for measuring the level, velocity and volume of an electrically conductive liquid.
2,657,579 (S. Smith & Sons, Ltd., and Furzehill Laboratories, Ltd.) Liquid level-indicating device.
2,657,581 (Shell Development Co.) Gravity meter.
2,658,180 (Phillips Petroleum Co.) Vacuum tube voltmeter.
2,658,380 (Vincent J. Evans) Calibrator for thermostats.
2,658,382 (John Vanderkamp) Melting-point apparatus.
2,658,383 (Burgess-Manning Co.) Freezing-point tester.
2,658,384 (Hays Corp.) Gas-measuring device.
2,658,385 (Hays Corp.) Gas-measuring device.
2,658,392 (Foxboro Co.) Pressure-indicating pneumatic transmitter system.
2,658,469 (Foxboro Co.) Adjustable index arm for measuring instruments.
2,658,819 (John M. Formwalt) Apparatus for measuring chemical activity, particularly of catalysts.
2,659,381 (Standard Oil Development Co.) Pressure-amplifying device.
2,659,822 (U.S.A.) Mass spectrometer.
2,659,861 (Branson Instruments, Inc.) Apparatus for measuring thickness of a conductive body from one side only.
2,659,862 (Branson Instruments, Inc.) Apparatus for electrical measurement of thickness using current ratios.
2,660,054 (Sperry Products, Inc.) Ultrasonic thickness-measuring device.
2,660,057 (Republic Flow Meters Co.) Flow-measuring device.
2,660,059 (Phillips Petroleum Co.) Liquid level-measuring apparatus.
2,660,061 (Dominion Engineering Works, Ltd.) Portable immersion-type thermocouple temperature-measuring device.
2,660,086 (Standard Oil Co-Ohio) Apparatus for coordinating operating wave length and slit size in spectrophotometers.
2,660,146 (Foxboro Co.) Adjustable set point arm for control instruments.
2,660,147 (Foxboro Co.) Detachable index arm unit for measuring instruments.
2,660,378 (Republic Flow Meters) Boiler control apparatus.

Pumps & Compressors

2,657,638 (Byron Jackson Co.) Rotary pump.
2,658,452 (U.S.A.) Electromagnetic pump.
2,658,453 (Pacific Pumps, Inc.) Nonclogging pumping device.
2,658,454 (Pfaudler Co.) Glass-lined pump.
2,658,455 (De Laval Steam Turbine Co.) Impeller with center intake.
2,659,311 (George G. Schaffer) Centrifugal pump.
2,659,312 (W. H. Martin) Centrifugal pump.
2,660,121 (Thompson Products, Inc.) Multistage centrifugal pump.
2,660,122 (Goulds Pumps, Inc.) Centrifugal pump.
2,660,144 (Remco Incorporated) Indicator for visually observing the flow of a liquid through a pipe.

Valves & Fittings

2,657,898 (Alexander S. Volpin) A smooth-opening automatic, lubricated gate valve.
2,658,517 (Clark Mfg. Co.) Vapor trap.
2,658,712 (Friedrich Heinrich) Gate valve.
2,660,191 (Alexander S. Volpin) Gate valve.
2,660,192 (Edwin J. Hunter) Saddle valve.
2,660,397 (Alexander S. Volpin) Quick sealing automatic sealing gate valve.

Catalytic reactors

2,658,822 (Standard Oil Co.—Ind.) Fluidized solids system.
2,659,633 (Sun Oil Co.) System for elevating contact material.
2,660,520 (Standard Oil Development Co.) Apparatus for catalytic conversion of hydrocarbons.

How to Obtain Patents

Readers may obtain copies of any U. S. patent from the Patent Office at 25¢ each. Order by patent number direct from The Commissioner of Patents, Washington 25, D. C.

Burn Low Grade Fuels – Efficiently . . .

The Ljungstrom operates on the continuous regenerative counter-flow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

. . . with a LJUNGSTROM *air* PREHEATER

Low grade tars, pitches and asphalts used to be considered so low in recoverable heat value that they were often discarded. But the Ljungstrom Air Preheater points the way to the practical, efficient use of these former waste products.

Preheated air is a key factor in more efficient combustion, causing faster ignition and a short, hot flame. Rates of heat liberation are higher, too. Thus, with preheated air, low grade fuels with high ash and moisture content – and excessively lean fuels – are readily burned.

You get other advantages with a Ljungstrom, too: lower fuel costs . . . more economical furnace design . . . greater throughput . . . higher product quality – *all of these with the Ljungstrom, that pays out in just a few months.*

Wherever you are planning to expand or modernize your fuel burning equipment, it will pay you to consider a Ljungstrom Air Preheater. Call or write for full information.

THE AIR PREHEATER CORPORATION
60 East 42nd Street, New York 17, N. Y.

WHEREVER YOU BURN FUEL, YOU NEED LJUNGSTROM

OIL FIRM GIVEN AWARD BY ARMY—For its "wholehearted cooperation in granting leaves to employees so that they might participate in the Army reserve training program" the Tide Water Associated Oil Co. is presented an award from the U.S. First Army. Receiving the award is Frank W. Keebler, above right, assistant general superintendent of the Bayonne, N.J., refinery. Robert A. White, left, of the refinery's control laboratory and a reserve officer, makes the presentation.

B. L. Rodzianko has been appointed assistant manager of General Petroleum's 35,000 b/d refinery now under construction at Ferndale, Wash.

A University of Michigan graduate, Mr. Rodzianko started in 1938 as chemical engineer at Socony-Vacuum's Paulsboro, N. J., refinery, and took part in the development of the Thermofor catalytic cracking process.

In 1944 he was transferred to the company's Torrance, Calif., refinery, where he has held numerous posts, the latest being senior refinery engineer. He is a member of the American Chemical Society and the American Institute of Chemical Engineers.

Dr. James S. Cross has been appointed manager of the statistical research division of the Sun Oil Co. He was formerly an assistant professor of marketing at M. I. T., where he taught for six years. Dr. Cross has conducted a number of studies in the field of petroleum economics, and published articles on the subject in several management magazines, including McGraw-Hill's *National Petroleum News.*

Dr. Paul D. Foote, vice-president of Gulf Oil and Gulf Refining and executive vice-president of Gulf Research and Development, retired from active executive work at the end of December. Another member of the Gulf Research and Development staff who retired at that time is **Dr. E. A. Eckhardt,** vice-president and associate research director.

William I. Tierney has been named personnel superintendent of the Monsanto Chemical Co.'s St. Louis, Mo., plant.

Lester B. Swan has been appointed executive vice-president of Brazos Oil and Gas Co., Houston, Tex. Mr. Swan was formerly assistant general manager and coordinator of research for Dowell, Inc., Tulsa.

George Edward Holbrook, assistant director, development department, du Pont Co., has been given the American Institute of Chemical Engineers' professional progress award in chemical engineering for 1953. He was cited for his work in the production of organic chemicals. The award carries a grant of $1000 and is sponsored by the Celanese Corp. of America.

Dr. Holbrook has been with du Pont since 1933, except for one year that his services were lent to the government.

Dr. Paul H. Emmett, senior fellow of the Mellon Institute for Industrial Research and a leading physical chemist, has been given the 1953 Pittsburgh award of the American Chemical Society's Pittsburgh section. The citation mentioned his distinguished service to chemistry and to the community as a research scientist, lecturer and educator, and took particular notice of his contribution to the Brunauer-Emmett-Teller method for determining surface areas.

Dr. Emmett joined the Mellon Institute staff in 1944 on a petroleum refining fellowship to do fundamental research on the mechanism of catalytic reactions.

Harold G. Mangelsdorf is the new general manager of Esso Standard Oil Co.'s manufacturing department, having succeeded **William Naden** in the post on November 1. The move is designed to permit Mr. Naden to concentrate on his broader functions as vice-president and as primary contact director of the company.

Mr. Mangelsdorf

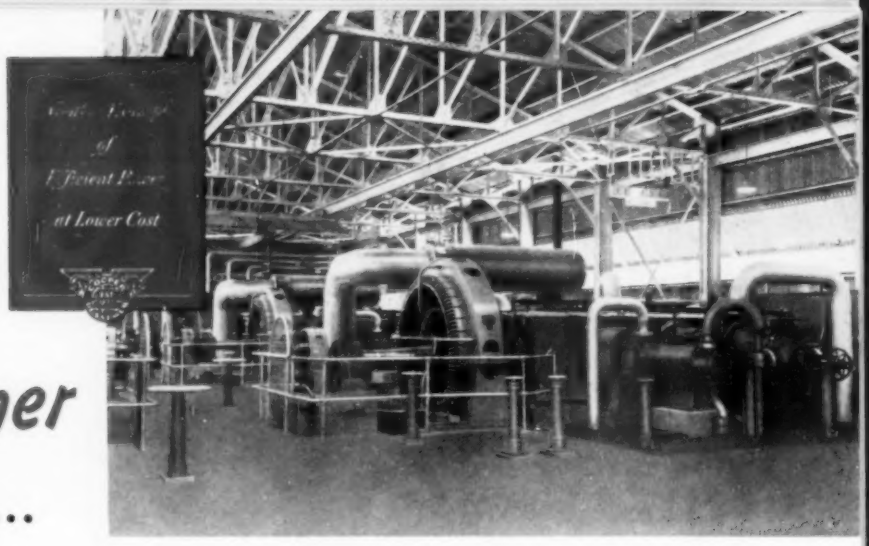
Mr. Naden

Mr. Leet

Charles Leet, who had been serving as manager of the Bayonne, N. J., refinery, has succeeded Mr. Mangelsdorf as general manager of the manufacturing department's east coast division.

Mr. Mangelsdorf earned a bachelor's degree in electrical engineering at Kansas State College in 1930, and a master's degree in fuel and gas engineering at M. I. T. two years later. He joined Esso at the Baton Rouge, La., refinery in 1934 as a combustion gas engineer.

He was assistant manager of the



Cooper-Bessemer

MODERN DESIGN...

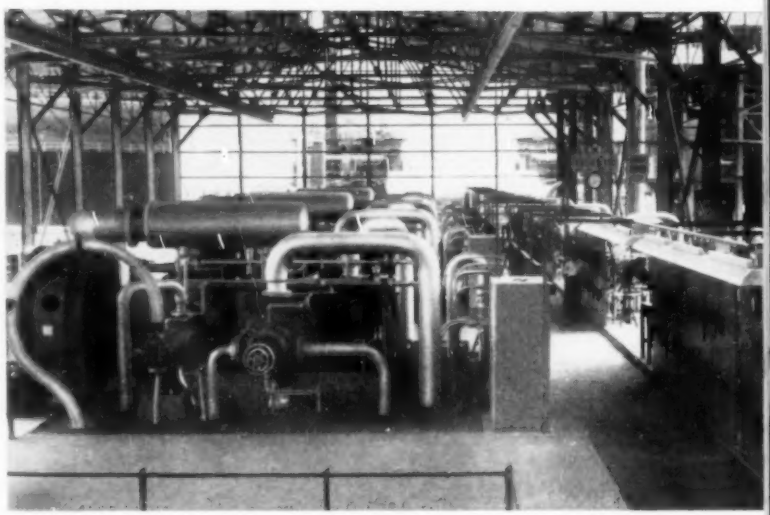
for compressors at Sindri . . . at Suez . . . everywhere!

● Shown opposite are Cooper-Bessemer motor-driven compressors in two of the world's newest and largest synthetic ammonia plants.

The top view shows part of the 22,000 Cooper-Bessemer M-Line compressor horsepower installed in the ammonia synthesis plant of the Sindri Fertilizer Factory, Bihar Province, India. Here, ammonium sulphate can be produced at a rate of 1,000 tons a day — 350,000 tons a year!

Similarly the other photo shows a line-up of Cooper-Bessemer compressors in the large Suez plant of the Societe Egyptienne D'Engrais et D'Industries (S.A.E.), Egypt. Here, calcium nitrate fertilizer is produced at a rate of 200,000 tons yearly.

In both plants, these modern Cooper-Bessemer units handle the entire compressing job and comprise the heart of production operations. For, with Cooper-Bessemers, you can be sure of year-in, year-out performance at the lowest operating cost.



Cooper-Bessemer M-Line motor-driven compressor in the synthesis section of the Sindri Fertilizer Factory, India. Here eight 2,750 hp 7-cylinder units compress gas through six stages to a pressure of 5,500 psi. The huge Sindri plant was engineered by the Chemical Construction Corp., New York, and built under the direction and supervision of the Power-Gas Corp., Ltd., England.

Here, in the Suez plant of the Societe Egyptienne D'Engrais et D'Industries (S.A.E.), these four 2,750 hp JM-5 motor-driven units compress 25,344 mcf of gas daily from atmospheric to 5,200 psi for initial calcium nitrate production of 200,000 tons yearly. This plant, engineered by the Chemical Construction Corp., utilizes waste gases from nearby oil refineries.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York City Washington, D. C. Bradford, Pa. Parkersburg, W. Va.
San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas
Seattle, Wash. Shreveport, La. St. Louis, Mo. Los Angeles, Calif.
Caracas, Venezuela Gloucester, Mass. Tulsa, Okla. New Orleans, La.

Baton Rouge plant when he moved to Bayway, N. J., in 1950 to become general superintendent. He served as general manager of the manufacturing department's east coast division for a year prior to his new appointment.

Mr. Naden specialized in chemistry at the Lowell Textile School. He was first employed by Esso as a chemist at the Everett refinery in 1927, and a series of promotions brought him to the post of general superintendent of the plant in 1934.

During World War II he served in the Petroleum Division for War as director of refining for District No. 1. Returning to the company in 1944, Mr. Naden was made head of Esso's employee relations department. In 1946 he became a company director, general manager of manufacturing in 1949 and vice-president the following year.

Mr. Leet moved into the newly created post of manager of the Bayonne refinery last February, transferring from the Baton Rouge refinery. A graduate of West Virginia University in 1930, with a bachelor's degree in chemical engineering, he joined Esso the same year at Bayway as a student engineer. He moved to Baton Rouge the following year as a chemical engineer. He became head of the process engineering department in 1939, head of the technical division in 1946 and assistant general manager of Louisiana manufacturing in 1950, the post he held when he transferred to Bayonne last February.

Paul Bearden has been appointed manager of the manufacturing department of the Texas Gas Corp.'s Winnie, Tex., plant.

Henry F. Newman has been appointed assistant chief engineer at the Standard Oil of Indiana refinery at Casper, Wyo. Mr. Newman was formerly assistant head engineer of the design department at the company's Whiting, Ind., plant.

E. E. Ebner, general superintendent of Quaker State Oil Refining Corp. refineries, has been cited by the University of Michigan's College of Engineering for his outstanding achievement and contributions to the development of petroleum processes and operations. The citation was made at a recent celebration of the Engineering College's centennial.

Mr. Ebner, a graduate of the University of Michigan as a chemical engineer, has been associated with Quaker State Oil Refining Corp. since 1928. He is a director of the Pennsylvania Crude Oil Association and chairman of its Technical Advisory Committee.

R. M. Waters and **J. A. Wilkinson** are recent additions to the staff of Dow Chemical Co.'s Texas division, Freeport. Both men are working in the chemical engineering department, Mr. Waters as a chemist and Mr. Wilkinson as a research and development engineer.

Another new employee in the Texas division is **B. T. Jordan, Jr.,** who is working as a research and development engineer in the organic research department.

R. W. McOmie has been named manager of the Shell Oil Co.'s new 50,000 b/d refinery currently under construction at Anacortes, Wash. The refinery is expected to begin operations in 1955. **P. J. Merkus,** assistant to the vice-president for manufacturing in New York, has been named manager of the Wilmington,Calif. 64,000 b/d refinery succeeding Mr. McOmie.

Mr. McOmie

Mr. McOmie has been directing preparations for the Anacortes plant, but in his new post he will devote full time to coordination of various activities and development and training of the operating organization.

Born in Sugar City, Idaho, Mr. McOmie earned a bachelor's degree in chemistry at Stanford in 1926, joined Shell the following year as a chemist at the Martinez, Calif., refinery and advanced through the company's ranks. In 1942, he was named assistant manager at Martinez. The next year he returned to Wilmington, where he became manager in 1945.

J. D. Walk, who was technical director at the El Dorado, Ark., refinery of Pan-Am Southern Corp., now manages the newly created technical service and economics group, with headquarters in New Orleans. His title is manager, technical service.

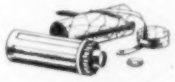
O. A. Fuchs, former assistant process superintendent at El Dorado, succeeded Mr. Walk as technical director. The former assistant superintendent of Utilities, **C. M. Durham,** now has the title of process superintendent, and **E. S. Chelchowski,** who was senior

what's NEW in Engineering

A synthetic soil conditioner has been announced which helps to control rain and wind erosion on construction sites, levees, rights of way and similar "bare ground" sites. Designed to stabilize aggregates on the soil surface, it helps to hold seeds and soil in place until vegetation cover takes over the job.

Deep-sea divers joined a small army of engineers and construction crews in driving over 42,000 piles at a riverside site for a Louisiana plant—to provide a stable foundation in mushy ground. Divers, working 40 feet down in the Mississippi River, were required to direct

placement of the concrete seal. We'll send you a 32-page illustrated book which tells how Kaiser Engineers is equipped to meet challenging problems—like this one at the nation's largest aluminum plant, which was producing metal in just 10 months.



A pocket pyrometer, now on the market, gives direct reading of temperatures up to 3,300 deg. F. Only six and one-half inches long, it weighs about five ounces, and is shaped like a miniature telescope.

Whether it's designing an oil refinery, building a porcelain enameling plant or laying out a site plan, Kaiser Engineers undertakes the job with assurance because of the variety of talent within the organization. Successful experience in a wide field of design, engineering and construction tells the story. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

(To obtain more data on advertised products see page 128)

J-M BLAZECRETE builds longer lasting refractory linings...

That's why it pays you to use this hydraulic setting refractory for temperatures to 3000F

Blazecrete* linings last longer because they resist spalling, withstand slagging action, and are not harmed by rapid temperature changes.

Thus you cut down on refractory maintenance costs—and you save on labor costs, too, because Blazecrete goes on fast. For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place. When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete may be applied easily without laborious ramming or tamping.

Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix—can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic-setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Reg. U.S. Pat. Off.

Whether you gun it... *or slap-trowel it...*

Johns-Manville **BLAZECRETE**

BUILDS BETTER REFRACTORY LININGS

staff engineer at New Orleans, is now assistant process superintendent.

R. F. Provine, who was assistant unit foreman at El Dorado, has been appointed hydroformer unit foreman and supervises operation of the new fixed-bed hydroformer now under construction, which will be the first of its kind.

C. W. Peters, who was on leave as manager of the economics department to serve for a year with the Petroleum Administration for Defense, has returned to Pan-Am as economics director at the Destrehan, La., refinery.

F. H. Field has been promoted to the post of senior research chemist in the research and development division of Humble Oil and Refining Co.'s Baytown, Tex., refinery. **E. O. McBride** has been given the title of technical specialist in the technical service division, and **J. A. Dinwiddie** is now a research specialist in the refinery's research and development division.

Seven new members were elected to the general committee of the American Institute of Petroleum's division of refining at the 33rd annual meeting, held the past November in Chicago. The new committeemen are as follows:

Fred B. Behrens, vice-president of manufacturing, Norwalk, Calif., refinery, Wilshire Oil Co., Inc.

Harry A. Brown, vice-president of manufacturing, Frontier Refining Co., Cheyenne, Wyo.

A. G. Farquharson, vice-president of refining, McColl-Frontenac Oil Co., Ltd., Montreal, Que., Can.

Harry A. Logan, president, United Refining Co., Warren, Pa.

W. Harold Rea, president, Canadian Oil Cos., Ltd., Toronto, Ont., Can.

J. L. Sewell, president, Taylor Oil and Gas Co., Taylor, Tex.

C. L. Suhr, chairman, board of directors, The Pennzoil Co., Oil City, Pa.

Marion W. Boyer, former general manager of the U. S. Atomic Energy Commission, has returned to the Esso Standard Oil Co. as vice-president, director and member of the executive committee.

Mr. Boyer worked with the AEC, as coordinator of the commission's construction program, for the past three years. He joined Esso Standard in 1927 from M. I. T., where he had been awarded his bachelor's and masters' degrees and had worked in the research laboratory. He eventually became the general manager of the Louisiana manufacturing division, and was elected a company director in 1945.

(To obtain more data on advertised products see page 128)

"on stream" in massachusetts

This Model IV Fluid Catalytic Cracking unit, with a capacity of 24,000 barrels per day, was the major process installation in an extensive modernization program recently completed by Foster Wheeler at the Everett, Massachusetts refinery of the Esso Standard Oil Company.

FOSTER WHEELER

write your music for Quartet

IN THE PETROLEUM PROCESSING INDUSTRIES

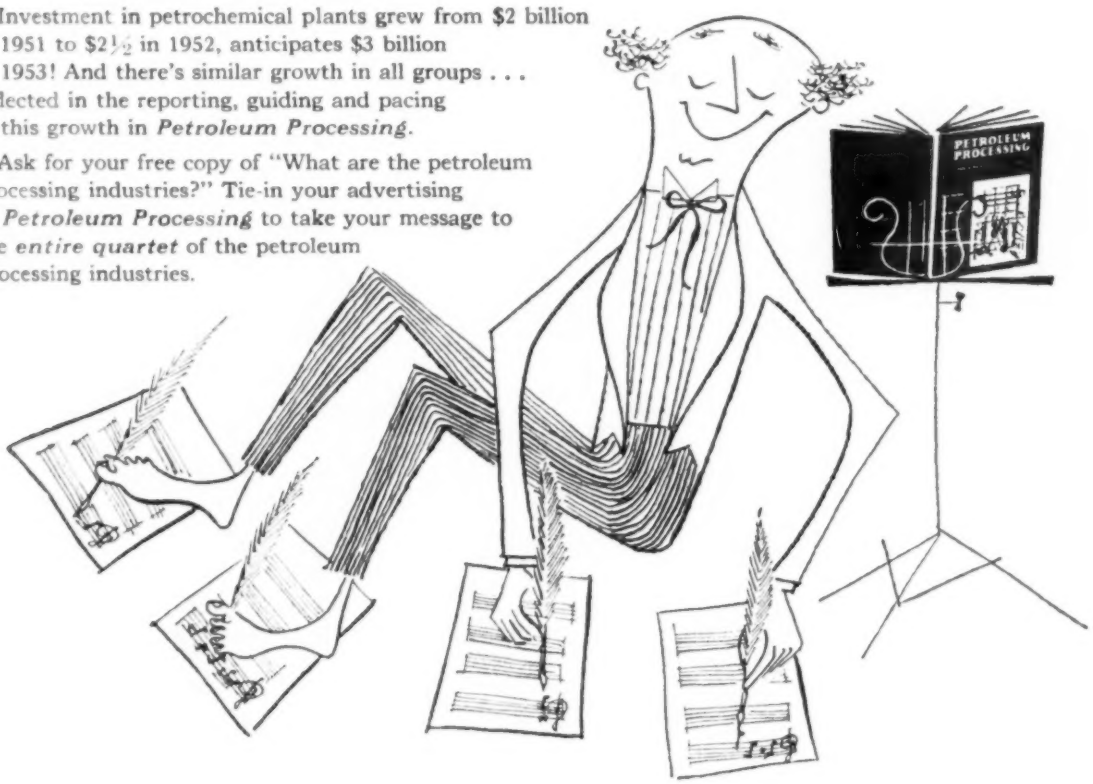
Solos are grand in a concert, but to have the petroleum processing industries singing the praises of your product, you need *an arrangement for quartet!*

There's one arrangement for your advertising which reaches all four important areas of this great industrial group. It's called *Petroleum Processing;* it goes directly, effectively, forcefully to all four groups:

1. Petroleum refining.
2. Petrochemical manufacturing.
3. Natural gasoline recovery.
4. Lube oil blending and compounding.

Investment in petrochemical plants grew from $2 billion in 1951 to $2½ in 1952, anticipates $3 billion in 1953! And there's similar growth in all groups . . . reflected in the reporting, guiding and pacing of this growth in *Petroleum Processing*.

Ask for your free copy of "What are the petroleum processing industries?" Tie-in your advertising in *Petroleum Processing* to take your message to the *entire quartet* of the petroleum processing industries.



PETROLEUM PROCESSING

A McGraw-Hill Publication

330 West 42nd Street
New York 36, N. Y.

BARKSDALE VALVES' NEW PLANT, shown above, is at the corner of Fruitland and Alcoa Avenues, Los Angeles. The assembly plant and general offices of the firm are in the building. The enlarged facilities provided by the new location were needed to cope with the increasing demand for hydraulic control equipment.

Firm to Make Penetron

Manufacturing rights of the "Penetron," a device that measures wall thicknesses of pipe, have been granted to Instruments, Inc., Tulsa, Okla., by the Texaco Development Corp., New York.

The instrument was first developed by O. W. Graham, now president of Instruments, Inc., while he was working for Texaco, and it later underwent considerable research and development at the hands of the Texaco Corp. The device, which has been renamed "Rad-O-Thik" by its new manufacturer, is designed to measure wall thicknesses without having access to the inside of the pipe and without removing it from service. It does this by measuring the amount of absorption which results when the pipe is placed between a gamma ray source and a Geiger-Mueller counter tube.

GE Supplies Atlantic Expansion

An estimated $930,000 worth of electric equipment was furnished by the General Electric Co. for the expansion of the Point Breeze, Philadelphia, Pa., plant of the Atlantic Refining Co.

G.E. supplied five large synchronous motors, two rated at 2250 hp. and one each at 3000, 4000 and 5000 hp., for Atlantic's new Orthoflow catalytic cracking unit and the sulfuric acid alkylation unit. The motors all will operate at 13,200 volts, which is calculated to afford greater over-all efficiency and a saving in copper. Forty-nine small motors ranging from 2 to 150 hp., starters, controls and outdoor metal-clad switchgear also were furnished for this phase of the expansion.

The anhydrous ammonia plant will use a total of eight G.E. synchronous motors in its operation, in ratings ranging from 400 to 1750 hp. All controls and switchgear used in the expansion are installed outdoors. No buildings were constructed for the equipment.

New Fischer & Porter Divsion

A new special products division of the Fischer & Porter Co. will concentrate on the development of special instruments and instrument components to contract specifications. Edward H. Muhleisen, who has served both as field engineer and applications engineer for the Hatboro, Pa., firm, is the manager of the new division.

Some of the developments of the firm's engineering staff in the past few years are a wide-range portable pressure-sensing instrument, accurate to 0.02%; a complete line of flow meters based on the variable-area metering principle; and a temperature-compensated viscosimeter.

UOP Builds New Catalyst Plant

A new catalyst manufacturing plant is under construction for Universal Oil Products Co. near the company's research and development laboratories at McCook, Ill., about 25 miles southwest of Chicago's loop.

The new facility, the fourth for manufacturing Universal's Platforming catalyst, will cover about three acres and is expected to go into production next summer. The plant will consist of two buildings, one to handle catalyst processing facilities, the other to serve as a warehouse.

The new facility's output will go principally to eastern, midwestern and far western refineries which license the Platforming process.

Processing facilities at the firm's southern plant, at Shreveport, La., are being expanded to increase the supply of the catalyst to that part of the country.

Kaiser Steel to Expand

A planned $8,000,000 expansion of the Kaiser Steel Corps.' Fontana, Calif., rolling mills is expected to increase production of steel plate, sheet and tin plate by 120,000 tons a year.

In particular, the expansion will increase by approximately 17% the Fontana plant's output of flat rolled steel products. A 50% increase is planned for the continuous electrolytic tinning line, which means a yield of this type of metal of 200,000 tons a year. The plate mill and hot strip mill, operating continuously in tandem, will enlarge their output by about 10,000 tons a month.

Geiger Made Davison President

Marlin G. Geiger has been elected president and chief executive officer of the Davison Chemical Corp., Baltimore, Md., following the resignation as president of R. L. Hockley.

Mr. Geiger

Mr. Hockley was with the Davison firm since 1934. He was made vice-president for marketing in 1942 and executive vice-president in 1951. His elevation to president was in 1952.

Mr. Geiger's college education was in chemical engineering, and he held several technical and administrative positions in the chemical industry before entering the Davison Corp. in 1947. His first position with Davison was as executive vice-president, and he was elected to the board of directors during his first year. In 1951 he became the vice-chairman of the board, the position he held at the time of his latest promotion.

Marlow–Bell & Gossett Merge

A merger has been effected between Marlow Pumps, Ridgewood, N. J., and Bell & Gossett Co., Morton Grove, Ill. The latter firm makes a line of heating

NOW! SHAFT DRIVE POWER in LIGHT hauling!

TOTAL OPERATING COST 3/4¢ PER MILE

- EXTRA POWER
- EXTRA CAPACITY
- EXTRA ECONOMY

Slash inner plant handling and delivery costs as have hundreds of other plants. Put Cushman 780 TRUCKSTERS on your jobs—NEW this year with SHAFT DRIVE. Complete with 3 speeds forward, one reverse. Get the EXTRA power advantages of big vehicle shaft drive—plus quick, easy handling AND low operating cost—less than a penny a mile. With capacity up to 500 pounds, TRUCKSTER can speed up hundreds of handling jobs for you!

Cushman

780 SHAFT DRIVE TRUCKSTER

- Write for FREE illustrated booklet
- See Your Nearest Cushman Dealer for FREE demonstration

SOLD and SERVICED NATIONALLY

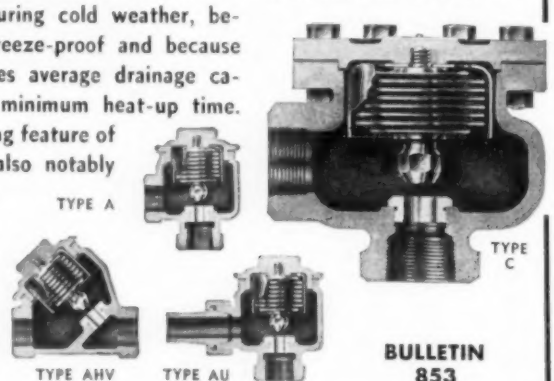
CUSHMAN MOTOR WORKS, INC. 962 No. 21st St. Lincoln, Nebraska

NICHOLSON MAKES

Freeze-Proof Steam Traps

for every Plant Use

Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Types for every plant use. Size ¼" to 2"; pressures to 250 lbs.



BULLETIN 853

215 OREGON ST., WILKES-BARRE, PA.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

specialties, universal pumps and flow control valves. Marlow Pumps manufactures self-priming centrifugal pumps and has a branch plant in Arkansas and licensed plants in France and England.

Products of the two firms will retain their separate identities throughout sales, marketing and distribution, though Marlow Pumps will add production capacity to its main plant at Ridgewood to manufacture Bell & Gossett's products.

In the new organization Marlow Pumps will be known as the Marlow division of Bell & Gossett and will be headed by A. S. Marlow, Jr., as general manager. He will also be a vice-president and a member of the board of directors of Bell & Gossett.

New Supply Firm Opened

A new supply company to serve the oil and chemical industries of the southwest has been founded at Shreveport, La., by W. M. (Sam) Haynes, former district manager of the Republic Supply Co. The new firm is known as Haynes Equipment Co. and handles a complete line of oil field, pipeline, chemical and industrial equipment and supplies, though it is building up a specialty in refinery equipment.

Mr. Haynes

Mr. Haynes was with Continental Oil Co. and Mathieson Chemical Corp. before joining Republic Supply Co. He was appointed manager of refinery and industrial sales for Republic in 1943, and in 1951 he became manager of its Shreveport, Ark-La-Tex and south Louisiana districts.

New Oil Well Supply Center

A new oil field supply center was opened in Houston, Tex., recently by Oil Well Supply, a division of the United States Steel Corp. The center consists of two units, a two-story building housing the store and office, and a structural steel warehouse measuring 320 by 80 feet.

The new center operates under the direct supervision of the area office and serves not only the industry operations around Houston and other stores in the Gulf area, but also provides access to Gulf Coast manufacturers' stocks through a buyer who has an office in the new building. Teletype

(To obtain more data on advertised products see page 128)

service from Gulf Coast stores provides quick contact with the area warehouse.

Kuljian Corp. Names New VP

H. H. Levonian has been appointed vice-president in charge of construction of the Kuljian Corp., a firm of engineers and constructors with headquarters in Philadelphia, Pa.

Mr. Levonian

Mr. Levonian has had 24 years of experience in the engineering and building of power and chemical processing plants both in this country and abroad. Among his past responsibilities has been engineering and design of water demineralization processes for petroleum catalytic cracking units and the design and construction of naphthaline-cracking process plants.

Personnel Changes

Rockwell Mfg. Co.—J. N. Holland to sales engineer for the Meter and Valve Division covering most of east Texas; Kenneth Rembert, who formerly handled part of this territory, will concentrate on the Port Arthur-Beaumont-Lake Charles area.

American Meter Co.—C. J. Kribs to assistant to the manager of the southern division, Westcott and Greis, Inc., a subsidiary of the American Meter Co.; Lee Holt to sales engineer covering parts of Arkansas, Louisiana and east Texas; Frank H. Allen and William Sumrall, Jr., to the sales organization.

Stone & Webster Engineering Corp.—William F. Ryan was named honorary member of the American Society of Mechanical Engineers at its December meeting in New York City.

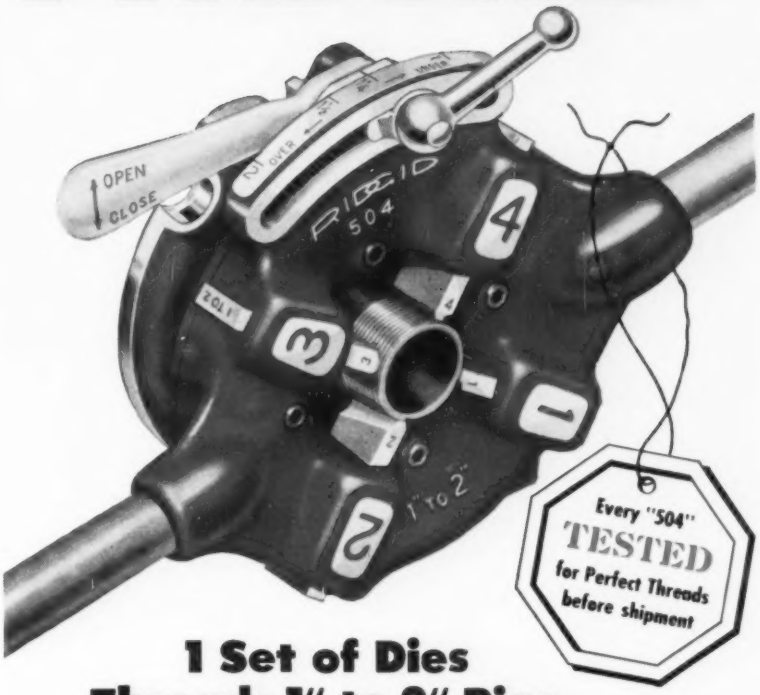
Edward Valves, Inc.—Rex E. Galloup to district manager of Texas and Gulf Coast area from sales manager for Oil Center Tool Co., Houston, Tex.

Durametallic Corp.—G. (Gil) A. Armour to field engineer for the Corpus Christi area.

Robertshaw Fulton Controls Corp.—Lee E. Cuckler to manager of the engineering department, Fielden Instrument Division, from head of tex-

For Easiest Pipe Threading ... it's a "504"

RIDGID



1 Set of Dies Threads 1" to 2" Pipe

- Instant change to 1", 1¼", 1½" or 2" pipe regardless of position of quick-opening lever.
- Wide open easy-to-read size bar . . . adjustable to over and undersize threads.
- Quick-opening lever retracts dies instantly without stopping power drive—no slow backing off.
- 4-jaw workholder centers pipe for accurate threading—no lead screw to jam.

For unmatched easy, fast, clean threading with your power drive, buy precision-made RIDGID 504 at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

(To obtain more data on advertised products see page 128)

Here are two great new generators that really do the work . . .

Gas Atmospheres has come up with two new atmosphere generators — a Nitrogen and an Inert — completely packaged units that are unsurpassed by anything in the field. **Compact** — these generators require less floor space per foot of gas than any generator made. **Foolproof** — they incorporate the latest approved safety devices . . . can be installed either inside or outside. **Production** — quality, uniform analysis atmospheres at constant out-put regardless of fluctuating supply gas. **Automatic** — push button control, easily accessible panel includes all controls.

Many other extras make these generators the finest available today. Before you buy generator equipment be sure to talk with a Gas Atmospheres engineer . . . it will pay off in the most efficient, inexpensive, trouble-free atmosphere production you've ever had.

For more complete information write for Bulletin number I-552

gas Atmospheres, inc

equipment for producing industrial gases

20011 WEST LAKE ROAD CLEVELAND 16, OHIO

Suppliers

tile and paper group, application engineering department at Brown Instrument Division, Minneapolis-Honeywell Regulator Co.

National Research Corp.—R. A. Knight to assistant sales manager of the equipment division.

Attapulgus Minerals & Chemicals Corp.—Wright W. Cary to president and chief executive officer succeeding Louis R. Streander, who has retired and assumed the position of consultant.

Oakite Products, Inc.—G. R. Wiggins to technical service representative, Kansas City area, handling petroleum and railroad accounts.

Magnesium Company of America—George O. Bohrer to chief engineer from assistant plant manager, Continental Can Co.

Calumet & Hecla, Inc.—Phil Powell to sales representative in southwestern district area.

General Aniline & Film Corp.—Dr. Frederick A. Hessel to commercial research manager of the commercial development department.

Maintenance Engineering Corp.—Alvin S. Vener to engineer on staff of firm, which is a sales representative for Graver Water Conditioning Co.

Worthington Corp.—John R. Hamill to manager of Kansas City district office; Paul J. Foley to general sales manager for products of Worthington's Plainfield, N. J., plant.

Du Pont Co.—John F. Shaw to assistant manager of the central district office, petroleum chemicals division; Barrett B. Russell to Wilmington, Del., as technical assistant to the sales manager of the petroleum chemicals division.

Branches, Distributors

Patterson Foundry & Machine Co. has opened a new sales office in Houston, Tex., with Wayne Schoonover as manager.

Foxboro Co. has opened a branch office in Amarillo, Tex., and assigned D. T. McElligott to it as the industrial engineer. The address is 1117 La Paloma St.

Enjay Co., Inc., has opened a regional office in Tulsa, Okla. Hector C. Evans is the manager, and Joseph E.

McGinniss is the office's technical representative for the southwest region.

Annin Co. has appointed three new distributors for its products. The Ben McKalip Co., Tulsa, Okla., will represent the firm in Oklahoma and the Texas Panhandle area. Trident Engineering Co., under the direction of Robert Kenyon and George Skopacek, will be Annin's northern California and San Francisco Bay area representative, and Farnes and Martig Co., Portland and Seattle, will act in behalf of the firm in Oregon and the western counties of Washington.

Franklin Supply Co. has opened a district sales office in Denver, Colo. Don Davis has direct supervision of the office, which is located at Room 608, Patterson Bldg.

Sarco Co., Inc., has opened a sales office in San Francisco, at 35 Elmira St., with J. S. Spear in charge.

Atlas Mineral Products Co. has made O. A. DeCell & Assoc. its midwestern sales representative. Address is 4900 West Madison St., Chicago, Ill.

Expansion, Transition

Van D. Clothier, Inc., west coast representatives of Wolverine Tube Division, Detroit, Mich., has moved its northern California branch to new and larger quarters at 19 South B Street, San Mateo. John Marshall continues as manager of the branch.

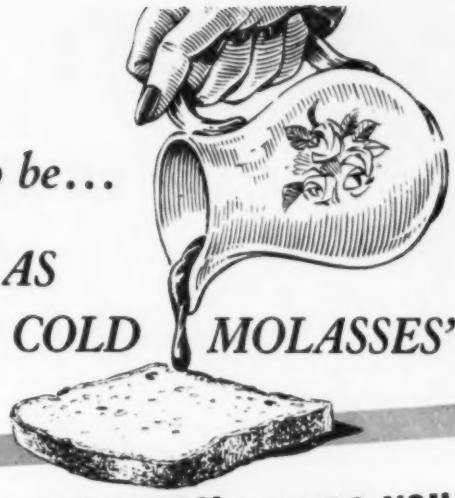
Diamond Power Specialty Corp. has moved into its new electronics laboratory adjacent to the manufacturing plant at Lancaster, Ohio. The building houses approximately 30,000 square feet of space.

Owens-Illinois Glass Co. has invested $8,000,000 in the Plax Corp., West Hartford, Conn., previously a wholly owned subsidiary of Emhart Mfg. Co. The transaction, announced as impending last June, followed a favorable decision by the U. S. District Court in Toledo on a petition by Owens-Illinois. Plax manufactures plastic sheet, rod, film, and squeeze bottles.

Turbine Equipment Co. has formed the Hynes Electric Heating Division for engineering, manufacturing and selling Hynes industrial electric heating equipment. Lee P. Hynes, who developed the equipment, has been retained as electrical and mechanical consulting engineer.

It used to be...

"SLOW AS COLD MOLASSES"



NOW SONNEBORN OFFERS YOU

free-flowing

PETROLEUM SULFONATES

SONNEBORN'S new ISO-PETRONATES are free flowing at room temperature. Now, for the first time, 62% concentrates can be used where steam is not available or where heating is difficult, assuring easier handling, suggesting new applications.

ISO-PETRONATES are but one example of the ability of SONNEBORN to adapt Petroleum Sulfonates to meet specialized requirements.

Where you require emulsification and dispersion of liquids... dispersion and wetting of solids... wetting and dispersion of liquid-solid systems... inhibition of rust and corrosion... one of the SONNEBORN oil soluble or water soluble Petroleum Sulfonates could be your answer.

THE COUPON BELOW MAY BRING THE ANSWER TO YOUR PROBLEM. CLIP AND MAIL IT TODAY!

Achieved by Sonneborn RESEARCH 1903 • 1953

L. SONNEBORN SONS, INC., Dept. PP-1
300 Fourth Avenue, New York 10, N. Y.

☐ Please send me technical data on Sonneborn's new Petroleum Sulfonates.

☐ We need specific information. Please have your representative call.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

(To obtain more data on advertised products see page 128)

WHAT IT IS! Wolverine Trufin Bi-metal is an aluminum finned tube having a liner of a different metal. *The entire fin construction is all one piece of metal.* Its fins are extruded right from the tube to greatly increase its outside surface.

THE FIRST REASON FOR SPECIFYING WOLVERINE BI-METAL: You have a choice of liner. The inside can be any corrosion-resistant alloy you may require to meet your specific condition.

THE SECOND REASON: Because the fins are integral, Trufin possesses greater heat transfer abilities in less space.

THE THIRD REASON: By virtue of this integral fin construction, Trufin has the stamina to stand up under vibration and sudden temperature changes.

THE FOURTH REASON: Because of the aluminum fin construction, Trufin bi-metal is light weight.

THE FIFTH REASON: Trufin can be fabricated, coiled or otherwise fabricated just like plain tube. Trufin can be had also in aluminum, all copper or copper-base alloys, electric-welded steel and other metals.

All types come in a variety of fin heights and spacings. Send for our new Condenser Tube Book giving all specifications. WOLVERINE TUBE DIVISION of Calumet & Hecla, Inc. 1441 Central Ave., Detroit 9, Michigan.

*REG. U.S. PAT. OFF. †A PATENTED PROCESS RE22465

Wolverine Trufin and the Wolverine Spun End Process† available in Canada through the Unifin Tube Co., London, Ontario.*

EST. 1916

WOLVERINE TUBE DIVISION
OF CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • Sales Offices in Principal Cities
EXPORT DEPT., 13 E. 40th ST., NEW YORK 16, N.Y.

Round Tables, Exhibits Set for Fifth Maintenance Conference and Show

THREE million dollars in products and equipment will be featured at the fifth Plant Maintenance and Engineering Show, to be held at the International Amphitheatre, Chicago, January 25-28.

The exhibits of 400 firms, occupying 100,000 square feet of display space, will be inspected by an estimated 20,000 persons from this country and abroad. It is expected that some 3000 experts will be on the exhibition floor to answer questions about the displays.

In addition to the show, a three-day conference will be conducted at the Hotel Conrad Hilton, and round-table discussions and sectional conferences will be held there on a wide variety of subjects. Eight industries, among them petroleum refining, will receive special attention, with two round tables devoted exclusively to their respective problems.

Round-table discussions of particular interest to petroleum refiners take place on Tuesday, January 26. In the morning there will be a discussion dealing with the inspection and upkeep of electrical distribution systems given by R. M. Ryan, application engineer, General Electric Co., Chicago; the maintenance of electronic control equipment, H. W. Bigelow, electronic control engineer, Westinghouse Electric Corp., Detroit, Mich.; handling equipment and methods of handling used in maintenance work, H. E. Shaw, division staff supervisor, feeder and service division, Westinghouse, Pittsburgh, Pa.; maintenance of materials-handling equipment, William P. Sheehy, chief maintenance engineer, B. F. Goodrich Co., Akron, Ohio; and maintenance in petroleum refining plants, William L. Bowler, assistant manager, maintenance and mechanical engineering, Pure Oil Co., Chicago.

Tuesday afternoon there will be a section conference on corrosion control and prevention for which the chairman will be L. B. Woolfenden, plant engineer, General Aniline Works Division, General Aniline & Film Corp., Grasselli, N. J. Discussion leader at this conference will be L. R. Honnaker, supervisor, engineering materials, consultant group, engineering service division, du Pont Co., Wilmington, Del.

Maintenance cost control and budgeting will be the topic of the general session on Wednesday morning. Chairman at this session will be Prof. Wilson P. Green, manager, heat-power research department, Armour Research Foundation, Illinois Institute of Technology, Chicago.

A final panel discussion at the end of the conference will include 16 speakers, who will attempt to answer all questions that were not satisfactorily dealt with at the individual round-table sessions.

As the round-table discussions are to run concurrently, they will be repeated Wednesday afternoon so as to give people a chance to attend those missed because of conflicts of schedule.

Measurement Is Theme of Instrument Conference

"PROGRESS in Measurement" will be the theme of the ninth annual regional conference of the Instrument Society of America, which will be held at the Hotel Statler, New York City, on February 4. The conference will examine this progress as it affects the work of four major technical fields—power, process, medicine and aviation.

Of interest to the petroleum industry are four papers which will be presented during the process section of the conference, when the presiding chairman will be T. Watkins, Vitro Corp.

The first of these will treat automatic control in industrial process plants, a paper to be given by V. V. Tivy, manager of refinery sales division, Foxboro Co. This is to be followed by a paper by C. B. Nolte, vice-president, Barton Instrument Corp., on the effects of the ambient temperature of the meter on flow measurement. Then there will be "Differential Pressure Transmitter, Resotronic Analyzer, and Miniature Pneumatic Receiver-Indicator," by P. Sellers, sales manager of Fischer and Porter Co., followed by a talk on infrared process analyzers given by Dr. V. Z. Williams, director of the Perkin-Elmer Corp.

Banquet speaker at the event will be Dr. S. A. Goudsmit, Brookhaven National Laboratory, who will address the group on his work in the atomic energy field.

Oil Man's Calendar

JANUARY, 1954

Society of Automotive Engineers, annual meeting and engineering exhibit, Sheraton-Cadillac and Statler Hotels, Detroit, Mich., Jan. 11-15.

National Constructors Ass'n, annual meeting, Commodore Hotel, New York City, Jan. 12-14.

American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York City, Jan. 12-14.

Plant Maintenance and Engineering Show, International Amphitheatre, Chicago, Ill., Jan. 25-28.

Texas A. & M. College, symposium on "Instrumentation for the Processing Industries", College Station, Texas, Jan. 27-29.

FEBRUARY

Instrument Society of America, annual regional conference, Statler Hotel, New York City, Feb. 4.

Western Petroleum Refiners Ass'n, regional meeting, Hotel Beaumont, Beaumont, Texas, Feb. 11-12.

Natural Gasoline Ass'n of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Texas, Feb. 26.

MARCH

American Society for Testing Materials, spring meeting, Hotel Shoreham, Washington, D. C., March 1-5.

Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, William Penn Hotel, Pittsburgh, Pa., March 1-5.

National Ass'n of Corrosion Engineers, 10th annual conference and exhibition, Kansas City Municipal Auditorium, Kansas City, Mo., March 15-19.

Western Petroleum Refiners Ass'n, annual meeting, Plaza Hotel, San Antonio, Texas, March 29-31.

APRIL

American Society of Lubrication Engineers, Netherland-Plaza, Cincinnati, Ohio, April 5-7.

National Petroleum Ass'n, 51st semi-annual meeting, Cleveland Hotel, Cleveland, Ohio, April 14-16.

Natural Gasoline Ass'n of America, 33rd annual convention, Baker Hotel, Dallas, Texas, April 21-23.

Ass'n of Consulting Chemists and Chemical Engineers, symposium and banquet, Hotel Belmont Plaza, New York, April 27.

MAY

American Petroleum Institute, Division of Refining, 19th mid-year meeting, Rice Hotel, Houston, Texas, May 10-13.

2nd Basic Materials Exposition and Conference, International Amphitheatre, Chicago, Ill., May 17-20.

JUNE

American Society for Testing Materials, 57th annual meeting and exhibit of testing apparatus, Sherman and Morrison Hotels, Chicago, Ill., June 14-18.

American Institute of Chemical Engineers, meeting on nuclear energy, University of Michigan, Ann Arbor, Mich., June 20-23.

JULY

1st Western Plant Maintenance Show, Pan Pacific Auditorium, Los Angeles, Calif., July 13-15.

NOW *You* CAN MEASURE THE PERCENTAGE OF HYDROGEN IN LIQUID HYDROCARBONS . . .

THE

NEW cenco®

Beta Ray H/C Meter

utilizes radioisotopes

•

FOR PRODUCT ANALYSIS

•

FOR INDUSTRIAL LABORATORY USE

•

FOR RESEARCH

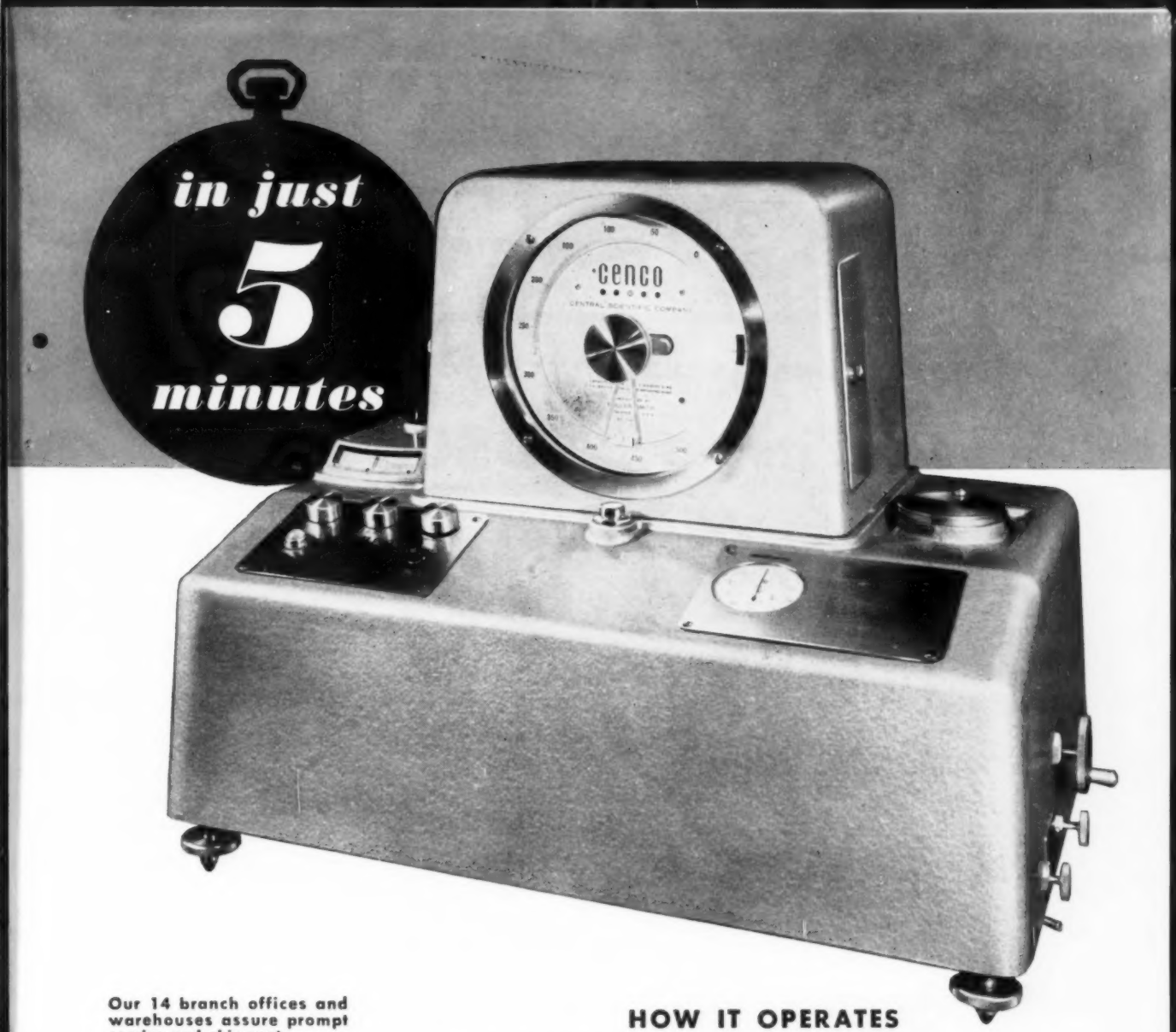
Now . . . for the first time . . . a practical, dependable, and accurate instrument is available for quick determination of the hydrogen content of liquid hydrocarbons. The new Cenco Beta Ray H/C Meter provides an easy and fast means of obtaining this information. With this revolutionary apparatus, hydrogen determinations can be made by a laboratory technician in five minutes with an accuracy of 0.02 weight percent hydrogen.

The customary organic combustion train method requires 4 hours per determination, and a skilled laboratory technician and produces results having an accuracy of 0.05 weight percent hydrogen.

The measurement of hydrogen in a hydrocarbon is of extreme importance in petroleum processing today. In many refining operations the hydrogen-carbon ratio is altered. The percentage of hydrogen is an index to the performance of end products, as fuel oils, jet fuels, gasolines, etc. With a Cenco Beta Ray H/C Meter, accurate measurement is made wherever needed . . . in product analysis . . . or in the research laboratory. Guesswork is eliminated. Delays are avoided.

Based on beta ray absorption.

This new instrument makes use of the absorption of beta rays obtained from the radioactive decay of strontium 90. Hydrogen contains approximately twice as many electrons per unit weight as other elements, and absorbs beta rays more efficiently on a weight basis. This basic principle makes possible the rapid and precise determination of hydrogen.



Our 14 branch offices and warehouses assure prompt service and shipment.

The Cenco Beta Ray H/C Meter is manufactured by Central Scientific Company under license by Standard Oil Company (Indiana).

HOW IT OPERATES

To make the hydrogen test, a sample of the liquid hydrocarbon is poured into a cell within the apparatus. The beta ray source is made to radiate equally in two directions, each going to a separate detector. One passes through a fixed absorber, and the other through an absorber that can be moved and also through the sample.

The movable absorber is shifted until a galvanometer shows equal currents are being produced by the two radiations. Then, by reading the position of the absorber the necessary data is quickly obtained.

Write today • Ask for our Bulletin No. 115

cenco

The most complete line of scientific instruments and laboratory supplies in the world

R.S.C.

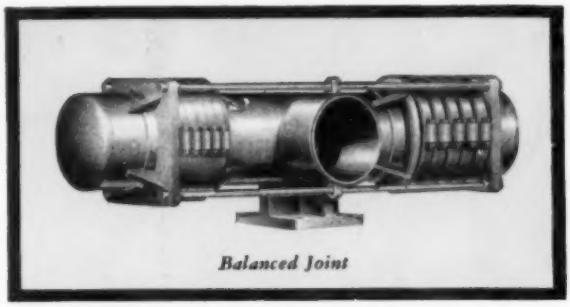
CENTRAL SCIENTIFIC COMPANY

MAIN OFFICE — PLANT — CENCO INTERNATIONAL CIA.
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS

BRANCHES AND OFFICES — CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO SANTA CLARA LOS ANGELES

CENTRAL SCIENTIFIC CO. OF CANADA, LTD. (and Hendry Division)
TORONTO MONTREAL VANCOUVER OTTAWA

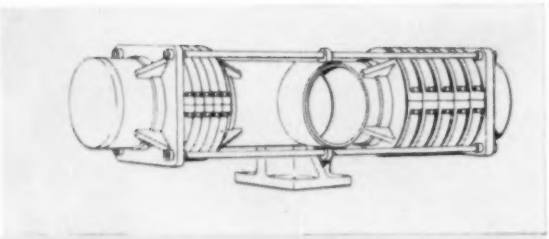
REFINERY SUPPLY COMPANY — TULSA HOUSTON



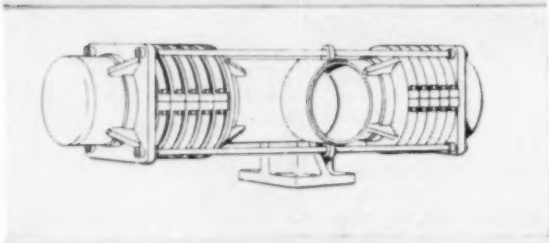
Balanced Joint

FOR A BALANCED SELECTION

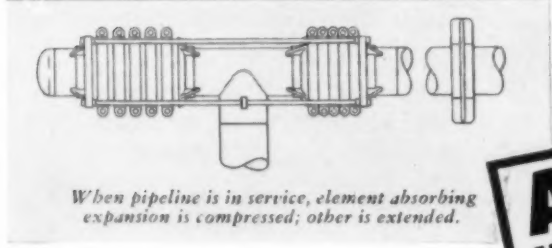
Look First at ADSCO *Corruflex* EXPANSION JOINTS



Balanced Joint Before Absorbing Expansion.



Balanced Joint After Absorbing Expansion.



When pipeline is in service, element absorbing expansion is compressed; other is extended.

• Buying an expansion joint from ADSCO is like shopping in a super-market. Everything you need is under one roof. Offering the world's most complete line of both slip and packless expansion joints, ADSCO is the only manufacturer able to supply the right joint for every purpose. ADSCO's complete line is backed up by an engineering service which since 1877 has found exact solutions to customers' special problems.

An example of ADSCO's versatility is the Corruflex Balanced Joint illustrated here. This packless expansion joint is designed to accommodate axial motion and eliminate end thrust at pipe intersections. The rods tie the joint ends together, thereby transmitting the end thrust to a distant point where adequate anchorage is available. The joint thus requires only the equivalent of an intermediate or stabilizing anchor.

So when you're shopping for expansion joints, come to ADSCO first. You won't have to look elsewhere . . . Call your ADSCO representative or write for Bulletin 35-51A.

ADSCO ENGINEERED PRODUCTS

EXPANSION JOINTS • HEAT EXCHANGERS • TRAPS STRAINERS • SEPARATORS • METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

Lagging Winter Undoes Refiners' Work In Holding Down Crude Runs to Stills

Outlook: Pressure from both gasoline and distillate stocks will hold down crude runs. . . . Prolonged cold weather needed to take the bulge out of heating oil stocks . . . . Gasoline demand strong but stocks by year end will be less than 10,000,000 bbls. below the 1952 peak, in March. . . . Lower refinery output will firm the residual fuel market east of California.

THE mild early winter, particularly in the east, to the middle of December had offset the smaller production of heating oils at refineries and the surplus of these stocks over comparable 1952 inventories has been increasing.

In the past few years, refiners have shipped 40% of their heating oil supplies (distillate fuels and kerosine) in November and December and 60% in January, February and March. For the U. S., the indicated shipments in November were around 59,100,000 bbls. and for December at around 76,200,000 bbls., a total of 135,300,000 bbls. for the two months. A year ago, shipments were around 145,000,000 bbls. in November and December, and the volume for 5 months was about 367,000,000 bbls. Prolonged cold weather early in 1954, to be expected unless the heating season is abnormally warm, would make up for the early deficiency in demand at refineries and bring down the present high level of stocks.

Primary distillate stocks (largest factor in heating oil inventories) east of California were nearly 113,000,000 bbls. Dec. 12, 14.7% higher than on the corresponding date in 1952. More important, however, is the fact that the surplus of these inventories over a year ago has been growing. East of California the surplus of distillate inventories over 1952 was 13% in early November, and it was only 5% greater on Oct. 3 than on Oct. 4, 1952.

The most noticeable change in the relationship of distillate inventories at refineries is in the interior refining districts. On Dec. 12 they were 8.7% larger than on Dec. 13, 1952. In early November they were 5-6% larger, while in early October the total of distillate stocks at interior refineries was slightly under the figure for the same date in 1952.

East and Gulf Coast primary distillate stocks combined, Dec. 12, were 19% larger than on Dec. 13, 1952. The first of November they were 17% larger and in early October around 11% greater.

Refiners have done their part to meet the situation caused by the high distillate and kerosine stocks. Not only has less crude been run to stills in recent months, but distillate yields have been lower and output of distillate fuels some months under that of a year ago.

Gasoline: Despite the increased rate of motor fuel production, the demand at refineries continues high enough that the buildup in stocks until the middle of December has not been quite as steep as a year ago. U. S. gasoline stocks Dec. 12 were 17.7% larger than Dec. 13, 1952. At the start of November, they were 18% larger and at the start of October 19% larger. East of California, the difference in stocks early in October was 16% and Dec. 12, 15.1%. Stocks were fairly evenly distributed among the various refining districts, except for California and the East Coast. California inventories were nearly 39% larger Dec. 12 and East Coast inventories 8.4% larger. Gulf Coast stocks, being nearly 25% larger, brought the total for the East and Gulf Coast to 16% greater than a year ago.

Gasoline demand at refineries in November was indicated as 7.7% greater than November, 1952—a higher rate of increase than for earlier months.

Residual Fuel Oils: Refinery output has been some under a year ago and imports moderately larger, while demand east of California has been sufficient to reduce stocks there to 1,800,000 bbls. less than a year ago, causing the recent strength displayed in the markets. Largest deficiencies in stocks are in the Texas Gulf Coast and the Ind.-Ill.-Ky. district. See Table 1. Texas Gulf, while running only slightly more crude, in December was producing around 35,000 b/d less heavy fuel oil.

Pressure of Stocks Holds Down Crude Runs

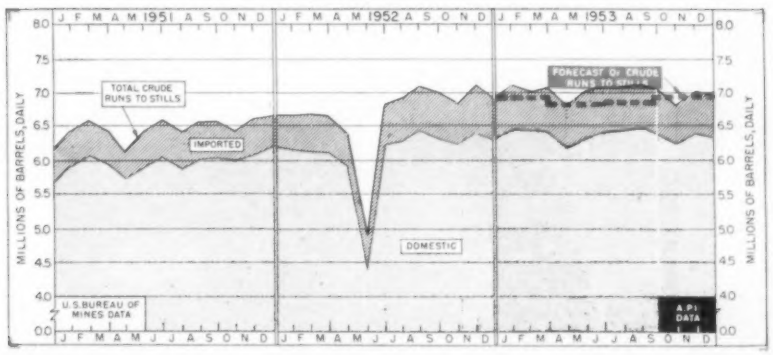

J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL CRUDE RUNS TO STILLS
IMPORTED
DOMESTIC
FORECAST OF CRUDE RUNS TO STILLS
U.S. BUREAU OF MINES DATA
A.P.I. DATA
J F M A M J J A S O N D

Table 1—Refinery Stocks of Residual Fuel Oil by Refinery Districts Dec. 12, 1953 and Dec. 13, 1952

(Thousand barrels, API Data)

	Dec. 12 1953	Dec. 13 1952	Change Amount	Change %
East Coast	11,642	11,770	— 128	1.1
Gulf Coast	8,375	9,151	— 776	8.5
Total Coastal	20,017	20,921	— 904	4.3
Appalachian	1,059	985	+ 74	7.5
Ind.-Ill.-Ky.	4,657	5,554	— 897	16.1
Okla.-Kans.-Mo.	1,290	1,586	— 296	18.7
Other Inland	2,504	2,248	+ 256	11.4
Total Inland	9,510	10,373	— 863	8.3
Total East of Cal.	29,527	31,294	—1,767	5.6
California	20,928	18,587	+2,341	12.6
Total U.S.	50,455	49,881	+ 574	1.2

Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
Dec. '53 API*	6,329	600	6,929
Dec. '52 BM	6,359	593	6,952
Change	—30	+7	—23
% Change	0.5	1.2	0.3

* Through Dec. 19.

Total (1000 bbls.)
(Bureau of Mines Data)

11 Mos. '53*	2,126,398	213,528	2,339,926
11 Mos. '52	2,038,076	187,679	2,225,755
Change	+88,322	+25,849	+114,171
% Change	4.3	13.8	5.1

* Oct. & Nov. estimated from API data.

BM Data on Crude Runs to Stills, 1953
(July 30, 1953; 1000 b/d avg. by quarters)

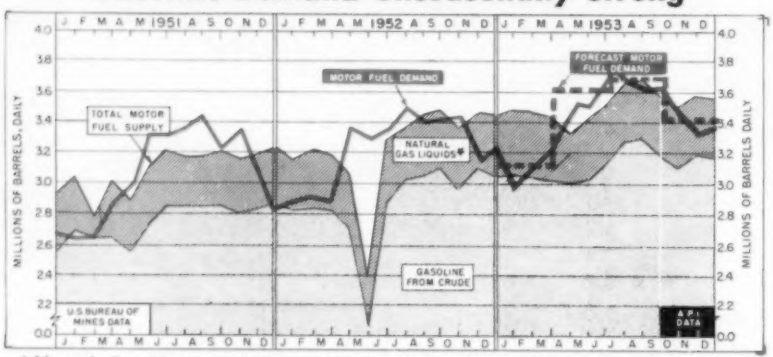
Actual Estimated Forecast
1st Q., 7,006 2nd Q., 6,959 3d Q., 6,991 4th Q., 7,044

Yields on Crude Runs to Stills

	Gasoline %	Kerosine %	Dist. Fuels %	Resid Fuels %
Dec. '53 API*	45.9	5.4	20.9	17.1
Nov. '53 API	45.3	5.0	20.9	18.5
Oct. '53 API	45.5	5.3	21.1	17.1
Dec. '52 BM	43.9	6.0	21.6	18.6

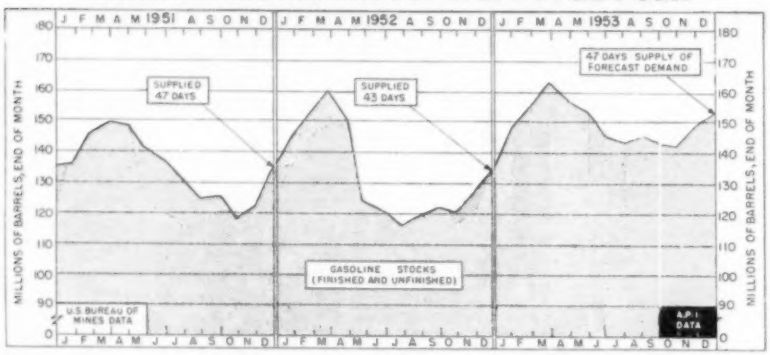
* Through Dec. 19.

Gasoline Demand Unseasonally Strong

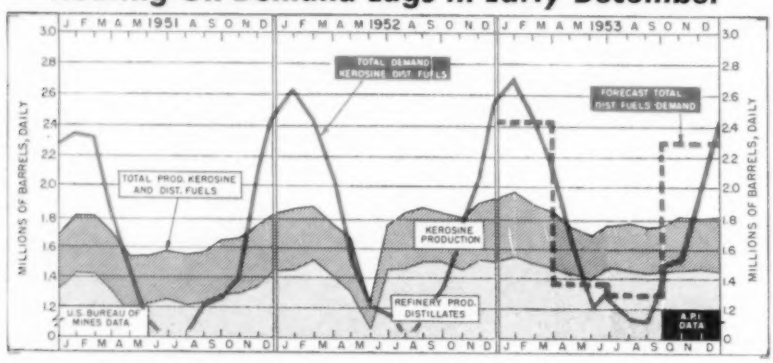

J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL MOTOR FUEL SUPPLY
MOTOR FUEL DEMAND
FORECAST MOTOR FUEL DEMAND
NATURAL GAS LIQUIDS*
GASOLINE FROM CRUDE
U.S. BUREAU OF MINES DATA
A.P.I. DATA

* Natural Gas Liquids include gasoline blended at refineries and that used as finished motor fuel.

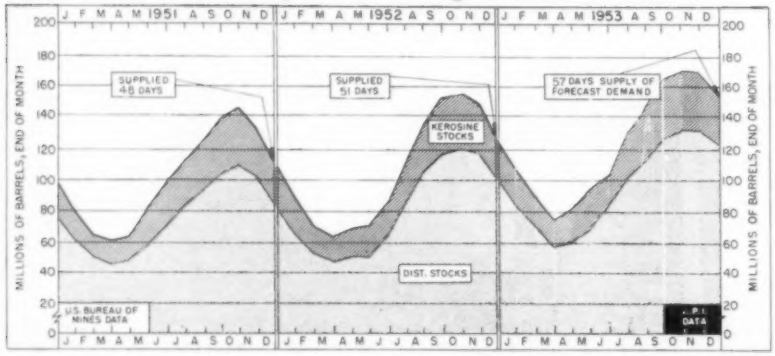
Gasoline Stocks Not Far from 1952 Peak


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 47 DAYS
SUPPLIED 43 DAYS
47 DAYS SUPPLY OF FORECAST DEMAND
GASOLINE STOCKS (FINISHED AND UNFINISHED)
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Heating Oil Demand Lags in Early December


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL DEMAND KEROSINE DIST. FUELS
FORECAST TOTAL DIST. FUELS DEMAND
TOTAL PROD. KEROSINE AND DIST. FUELS
KEROSINE PRODUCTION
REFINERY PROD. DISTILLATES
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Moderate Drop in Heating Oil Inventories


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 48 DAYS
SUPPLIED 51 DAYS
57 DAYS SUPPLY OF FORECAST DEMAND
KEROSINE STOCKS
DIST. STOCKS
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended	Used Direct	TOTAL
Dec. '53 API*	3,182		400	3,582
Dec. '52 BM	3,055		378	3,433
Change	+127		+22	+149
% Change	4.2		5.8	4.3

* Through Dec. 19.

Total (1000 bbls.)
(Bureau of Mines Data)

11 Mos. '53*	1,048,971	126,300	1,175,271
11 Mos. '52	957,293	126,056	1,083,349
Change	+91,678	+244	+91,922
% Change	9.6	0.2	8.5

* Oct. & Nov. estimated from API data.

Motor Fuel Demand

Including Exports
Daily Average (1000 bbls.)

Dec. '53 API*	3,389
Dec. '52 BM	3,261
Change	+128
% Change	3.9

* Through Dec. 19.

Total (1000 bbls.)
(Bureau of Mines Data)

11 Mos. '53	1,163,429
11 Mos. '52	1,090,042
Change	+73,387
% Change	6.7

* Oct. & Nov. estimated from API data.

BM Data on Motor Fuel Demand, 1953
(July 30, 1953; 1000 b/d avg. by quarters)

Actual	Estimated	Forecast
1st Q., 3,150	2nd Q., 3,610	3d Q., 3,674 4th Q., 3,435

Gasoline Stocks

Finished and unfinished, end of month (1000 bbls.)

Dec. '53 API*	153,586
Nov. '53 API	149,915
Oct. '53 API	143,268
Dec. '52 BM	136,028

* Dec. 19.

Heating Oils Production

(Kerosine and Distillates)
Daily Average (1000 bbls.)

	Kero-sine	Dist. Fuels	TOTAL
Dec. '53 API*	376	1,447	1,823
Dec. '52 BM	421	1,509	1,930
Change	−45	−62	−107
% Change	10.7	4.1	5.5

* Through Dec. 19.

Total (1000 bbls.)
(Bureau of Mines Data)

11 Mos. '53*	118,208	487,296	605,504
11 Mos. '52	119,239	474,496	593,735
Change	−1,031	+12,800	+11,769
% Change	0.9	2.7	2.0

* Oct. & Nov. estimated from API data.

Heating Oils Demand

Daily Average (1000 bbls.)

	Kero-sine	Dist. Fuels	TOTAL
Dec. '53 API*	544	1,914	2,458
Dec. '52 BM	594	2,057	2,651
Change	−50	−143	−193
% Change	8.5	7.0	7.3

* Through Dec. 19.

Total (1000 bbls.)
(Bureau of Mines Data)

11 Mos. '53*	109,984	458,855	568,839
11 Mos. '52	114,128	449,916	564,044
Change	−4,144	+8,939	+4,795
% Change	3.5	2.0	0.9

* Oct. & Nov. estimated from API data.

BM Data on Heating Oils Demand, 1953
(July 30, 1953; 1000 b/d avg. by quarters)

Actual	Estimated	Forecast
1st Q., 2,459	2nd Q., 1,398	3d Q., 1,283 4th Q., 2,321

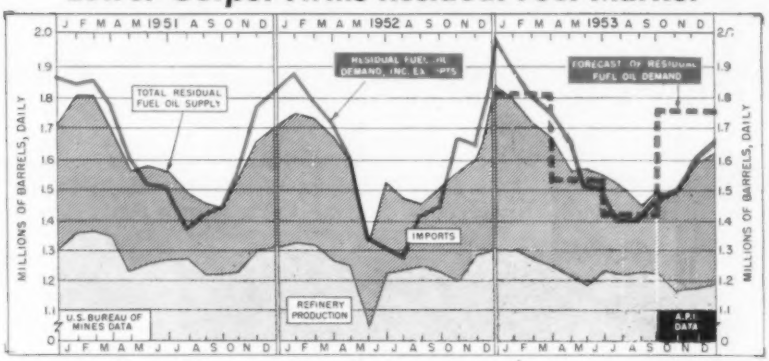
Heating Oil Stocks

(1000 bbls. end of month)

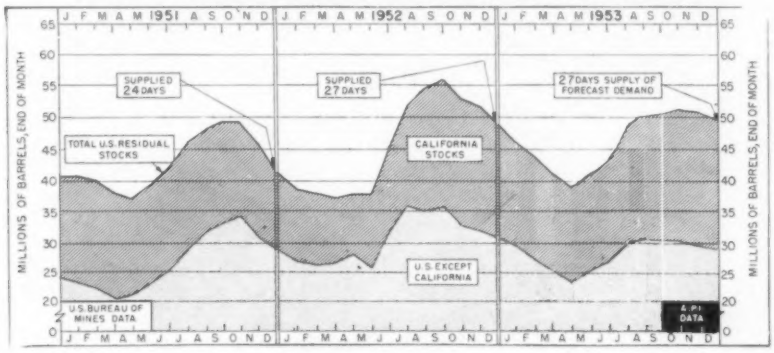
	Kero-sine	Dist. Fuels	TOTAL
Dec. '53 API*	32,389	123,444	155,833
Nov. '53 API	35,579	132,316	167,895
Oct. '53 API	37,963	134,831	172,594
Dec. '52 BM	26,842	99,582	126,424

* Dec. 19.

Lower Output Firms Residual Fuel Market


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL RESIDUAL FUEL OIL SUPPLY
RESIDUAL FUEL OIL DEMAND, INC. EXPTS.
FORECAST OF RESIDUAL FUEL OIL DEMAND
IMPORTS
REFINERY PRODUCTION
U.S. BUREAU OF MINES DATA
A.P.I. DATA

"Resid" Stocks East of Cal. Lower than in '52


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 24 DAYS
SUPPLIED 27 DAYS
27 DAYS SUPPLY OF FORECAST DEMAND
TOTAL U.S. RESIDUAL STOCKS
CALIFORNIA STOCKS
U.S. EXCEPT CALIFORNIA
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Residual Fuels Production

Daily Average (1000 bbls.)

	Refinery Output	Imports	TOTAL
Dec. '53 API*	1,187	435	1,622
Dec. '52 BM	1,302	538	1,840
Change	−115	−103	−218
% Change	8.8	19.1	11.8

* Through Dec. 19.

Total (1000 bbls.)
(Bureau of Mines Data)

11 Mos. '53*	409,752	120,322	530,074
11 Mos. '52	414,433	111,829	526,262
Change	−4,681	+8,493	+3,812
% Change	1.1	7.5	0.7

* Oct. & Nov. estimated from API data.

Residual Fuels Demand

Daily Average (1000 bbls.)

Dec. '53 API*	1,674
Dec. '52 BM	1,996
Change	−322
% Change	16.1

* Through Dec. 19.

Total Demand (1000 bbls.)

11 Mos. '53*	533,606
11 Mos. '52	521,897
Change	+11,709
% Change	2.2

* Oct. & Nov. estimated from API data.

BM Data on Residual Fuels Demand, 1953
(July 30, 1953; 1000 b/d avg. by quarters)
Actual — Estimated — Forecast
1st Q., 1,833 2nd Q., 1,542 3d Q., 1,429 4th Q., 1,763

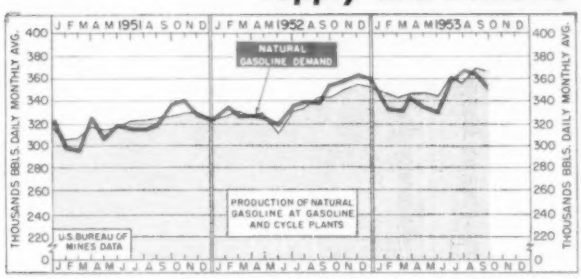
Residual Fuel Stocks

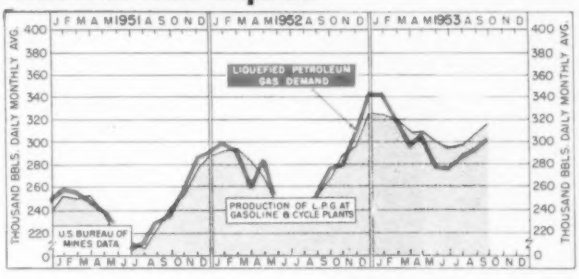
(1000 bbls. end of month)

	U.S. Except California	TOTAL U.S.
Dec. '53 API*	28,974	49,975
Nov. '53 API	29,943	50,956
Oct. '53 API	30,155	51,558
Dec. '52 BM	30,777	48,706

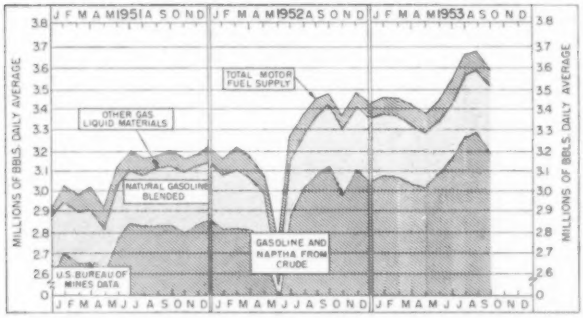
* Dec. 19.

Supply and Demand of Natural Gas Liquids


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
THOUSANDS BBLS. DAILY MONTHLY AVG.
NATURAL GASOLINE DEMAND
PRODUCTION OF NATURAL GASOLINE AT GASOLINE AND CYCLE PLANTS
U.S. BUREAU OF MINES DATA


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
THOUSAND BBLS. DAILY MONTHLY AVG.
LIQUEFIED PETROLEUM GAS DEMAND
PRODUCTION OF L.P.G. AT GASOLINE & CYCLE PLANTS
U.S. BUREAU OF MINES DATA

Makeup of Motor Fuel Supply


J F M A M 1951 A S O N D
J F M A M 1952 A S O N D
J F M A M 1953 A S O N D
MILLIONS OF BBLS. DAILY AVERAGE
TOTAL MOTOR FUEL SUPPLY
OTHER GAS LIQUID MATERIALS
NATURAL GASOLINE BLENDED
GASOLINE AND NAPTHA FROM CRUDE
U.S. BUREAU OF MINES DATA

(Figures in table in 1000 bbls./day average)

	Gasoline & Naphtha from Crude	Natural Blended	Other Gas Liquid Materials	Total Motor Fuel Supply
Sept. '53	3,188	333	70	3,591
Aug. '53	3,285	307	96	3,688
July '53	3,276	307	98	3,681
Sept. '52	3,122	306	71	3,499

Natural Gas Liquids Statistics

(Source: U.S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Supply* (1000 bbls./day avg.) Natural Gasoline	LPG	TOTAL	Demand** (1000 bbls./day avg.) Natural Gasoline	LPG	TOTAL
Sept. '53	365	317	682	352	304	656
Sept. '52	342	268	610	352	273	625
Change	+23	+49	+72	0	+31	+31
% Change	6.7	18.3	11.8		11.4	4.9
	Total Supply (1000 bbls.)			Total Demand (1000 bbls.)		
9 Mos. '53	96,349	84,254	180,603	94,605	82,025	176,630
9 Mos. '52	90,629	72,635	163,264	90,703	71,246	161,949
Change	+5,720	+11,619	+17,339	+3,902	+10,779	+14,681
% Change	6.3	16.0	10.6	4.3	15.1	9.0

	Stocks, End of Month (1000 bbls.) By type of product (At gasoline plants and terminals only) LPG	Natural Gasoline	Con-densate	Finished Gasoline†	By Location Gasoline Plants	Refin-eries	Total
Sept. '53	4,420	3,819	257	1,201	9,697	2,939	12,636
Aug. '53	4,038	3,492	264	1,121	8,915	3,044	11,959
July '53	3,579	3,340	290	1,041	8,250	3,003	11,253
Sept. '52	2,661	2,587	294	1,117	6,659	2,267	8,926

* Supply includes receipts from refineries as well as current production from natural gasoline and cycling plants. Receipts from refineries in September included 248,000 bbls. of natural gasoline.

** Demand does not include liquefied refinery gases produced for fuel and chemical purposes, which totaled 2,602,000 bbls. in September.

† Includes naphtha and other products.

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

AIR PREHEATERS, Ljungstrom: Full information; Air Preheater Corp. See adv't p. 108.

ALLOYS: Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers"; American Brass Co. See adv't p. 48.

BUBBLE CAPS and risers in any metal: Catalog 52; Pressed Steel Co. See adv't p. 28.

MATERIAL HANDLING, "Truckster," for intra-plant delivery: Booklet available; Cushman Motor Works, Inc. See adv't p. 114.

CATALYSTS, preformed: Eight-page booklet, "Harshaw Catalysts"; Harshaw Chemical Co. See adv't p. 40.

CAUSTIC SODA, uniform: Information; Hooker Electrochemical Co. See adv't p. 37.

CORROSION PROTECTION, metallic spray: Bulletin 62B; Metallizing Engineering Co., Inc. See adv't p. 137.

CORROSION PROTECTION: Information on Monel available; International Nickel Co., Inc. See adv't p. 33.

CUTTING DIES, for 1 to 2-inch pipe threads; Ridge Tool Co. See adv't p. 115.

DESALTING CHEMICALS and desalting service; Tretolite Co. See adv't p. 23.

EXPANSION JOINTS: Bulletin 35-51A; American District Steam Co., Inc. See adv't p. 122.

EXPANSION JOINTS: Information available; Zallea Bros. See adv't p. 18.

FASTENERS: Film, "Holding Power"; Bethlehem Steel Co. See adv't p. 35.

FLUID COKING PROCESS: Full details available; Fluor Corp. See adv't p. 1.

GASKETS, PACKING: Bulletins 810-V (valve packing); 1-339 WA (Teflon jacketed gaskets); United States Gasket Co. See adv't p. 134.

GENERATORS, atmosphere, nitrogen and inert: Bulletin I-552; Gas Atmospheres, Inc. See adv't p. 116.

GLASS-LINED STEEL: Bulletin 902-G1; Pfaudler Co. See adv't p. 82.

INSTRUMENT PANELS, graphic: Bulletin 471, "Consotrol Instrumentation"; Foxboro Co. See adv't p. 31.

INSTRUMENTS, Taylor "Fulscope" recording controller: Bulletin 98151; Taylor Instrument Co. See adv't pps. 44-45.

OXYGEN CONTROL: Bulletins 103 and 108, two types of oxygen analyzers; Arnold Beckman, Inc. See adv't p. 15.

PACKING, metallic: Bulletin DMPP; Durametallic Corp. See adv't p. 143.

REFRACTORY LININGS, "Blazecrete," hydraulic setting: Brochurer RC-28A; Johns-Manville Prod. See adv't p. 112.

REFRACTORIES: Publication, "Basic Materials Booklet"; Norton Co. See adv't p. 20.

RUPTURE DISC, safety heads for low pressure applications: Details available; Black, Sivalls & Bryson, Inc. See adv't p. 133.

SADDLE PACKING: Information, "Intalox"; U. S. Stoneware. See adv't p. 34.

SPOUTS, collapsible, 55 mm. nozzle assembly: Illustrated literature on complete line; American Flange & Mfg. Co. See adv't p. 14.

STAINLESS STEEL: Booklet on its performance in petroleum refinery service; United States Steel. See adv't p. 21.

STEAM GENERATORS: Bulletins available; Henry Vogt Machine Co. See adv't p. 32.

SULFUR DIOXIDE: Detailed information available; Tennessee Corp. See adv't p. 137.

TANK CLEANING with chemicals: Handbook of facts about "Oakite"; Oakite Products, Inc. See adv't p. 135.

TANKS, calibrating: Bulletin CT-102; Warner Lewis Co. See adv't p. 143.

TANKS, vessels: Graver Tank & Mfg. Co. See adv't p. 10.

THERMOMETER, mercury actuated: Catalog 200G; Palmer Thermometers, Inc. See adv't p. 137.

TUBE CLEANERS AND EXPANDERS: Data available; Airetool Mfg. Co. See adv't p. 139.

TURBINES, type DP: Bulletin GEA-4955A; General Electric Co. See adv't pps. 38-39.

VALVES, bronze gate, 125 and 150 lbs.: Folder, "Union Bonnet Bronze Gate Valve Catalog" available; Ohio Injector Co. See adv't p. 98.

VALVES, gate: Details available; William Powell Co. See adv't p. 43.

VALVES, high pressure, with "Swagelok" ends: Catalog; Crawford Fitting Co. See adv't p. 143.

VALVES: Information; Crane Valves. See adv't p. 17.

VALVES, forged steel: Information available; Orbit Valve Co. See adv't p. 112 B.

VALVES, TRAPS, FLOATS: Data available; W. H. Nicholson. See adv't p. 114.

more and more refineries..... * find KEY-KAST fittings and flanges right for their alloy piping needs!

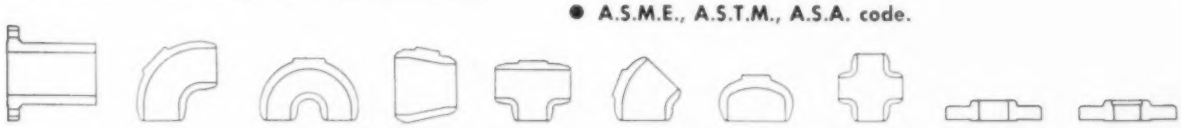
* *a few* KEY-KAST *users:*

Gulf Oil Corporation
Union Oil Company of California
Phillips Petroleum Company
Sun Oil Company
Atlantic Refining Company
The British American Oil Co., Ltd.

HOW DO THESE ADVANTAGES FIT *YOUR* ALLOY PIPING NEEDS?

- **Greater wall thickness throughout—for increased structural strength.**
- ***Extra* thickness in critical areas—for greater allowance against corrosion and erosion.**
- **Controlled quality . . . through rigid metallurgical control.**
- **Low unit cost . . . plus prompt deliveries.**
- **A.S.M.E., A.S.T.M., A.S.A. code.**

Key-Kast alloy welding fittings and flanges are available in low and intermediate alloys and various stainless steels.



Write for complete information and prices.

Key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

ADVERTISER'S INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

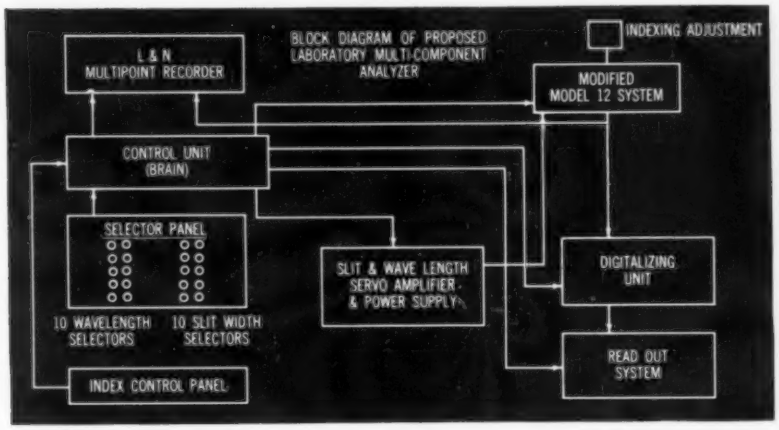
Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

(A-1) Airetool Mfg. Co., The 139
(A-2) Air Preheater Corp. 108
(A-3) Air Products, Inc. 47
(D-5) Allied Chemical & Dye Corp., Gen. Chem. Div. ..... Cover 3
(A-4) American District Steam Co. 122
(A-5) American Flange & Mfg. Co. 14
(A-6) American Locomotive Co. 24, 25
(A-7) Anaconda Copper Mining Co. 48
(A-8) Beckman, Inc., Arnold O. 15
(A-9) Bethlehem Steel Corp. 35
(B-1) Black, Sivalls & Bryson 133
(J-5) Calumet & Hecla Inc., Wolverine Tube Div. 118
(B-2) Central Scientific Co. 120, 121
(B-3) Chicago Bridge & Iron Co. 46
(B-4) Cooper-Bessemer Corp., The 110
(B-5) Crane Co. 17
(B-6) Crawford Fitting Co. 143
(B-7) Cushman Motor Works 114
(B-8) Dow Chemical Co. 136
(B-9) Dowell, Inc. 29
(C-1) Dresser Industries, Inc. 48B, 48C
(C-2) DuPont de Nemours & Co., Inc., E. I. 16A, 16B
(C-3) DuPont de Nemours & Co., Inc., E. I. 104
(C-4) Durametallic Corp. 143
(C-5) Enjay Co., Inc. 4
(C-6) Ethyl Corp. ..... Between Cover 2 and Page 1
(C-7) Fielden Instrument Div. 141
(C-8) Flint Steel Corp. 138
(C-9) Fluor Corp., Ltd., The 1
(D-1) Foster Wheeler Corp. 112A
(D-2) Foxboro Co., The 31
(D-3) Gas Atmospheres, Inc. 116
(D-4) General American Trans. Corp. ..6, 131
(D-5) General Chem. Div., Allied Chem. & Dye Corp. ..... Cover 3
(D-6) General Electric Co. 38, 39
(D-7) General Refractories Co. 13
(D-8) Girdler Corp., The 100
(D-9) Globe Steel Tubes Co. 80
(E-1) Graver Tank & Mfg. Co., Inc. 10
(E-2) Harshaw Chemical Co. 40
(E-3) Hartzell Propeller Fan Co. 2
(E-4) Hercules Powder Co. 22
(E-5) Homestead Valve Co. 16
(E-6) Hooker Electrochemical Co. 37
(E-7) Hudson Engineering Corp. ..... Cover 2
(E-8) International Nickel Co., The 33
(E-9) Johns-Manville Corp. 112
(F-1) Kaiser Engineers 111
(F-2) Key Co. 127
(F-3) Lukens Steel Co. 36
(F-4) Lummus Co., The 9
(F-5) McGraw-Hill Book Co. 135
(F-6) Metallizing Engineering Co., Inc.... 137
(F-7) Mixing Equipment Co. 52
(F-8) National Lead Co. 30
(F-9) Nicholson & Co., W. H. 114
(G-1) Nordstrom Valve Div., Rockwell Mfg. Co. 19
(G-2) Norton Co. 20
(G-3) Oakite Products 135
(G-4) Ohio Injector Co. 98
(G-5) Orbit Valve Co. 26
(G-6) Pacific Pumps Inc. 48A
(G-7) Palmer Thermometers Inc. 137
(H-3) Petroleum Processing ... .112B
(G-8) Pfaudler Co., The 82
(G-9) Powell Co., The Wm. 43
(H-1) Pressed Steel Co., The 28
(H-2) Pritchard & Co., J. F. 48D
(H-4) Refinery Supply Co. 140
(H-5) Ridge Tool Co., The 115
(G-1) Rockwell Mfg. Co., Nordstrom Valve Div. 19
(H-6) St. Mary Iron Works 140
(H-7) Scientific Design Co., Inc. 102
(H-8) Smith Corp., A. O. 94, 95
(H-9) Sonneborn Sons, Inc., L. 117
(I-1) Taylor Forge & Pipe Works 79
(I-2) Taylor Instruments Co. 44, 45
(I-3) Tennessee Corp. 137
(I-4) Tretolite Co. 23
(I-5) U. S. Gasket Co. 134
(I-6) U.S. Steel Corp. 21
(I-7) U.S. Stoneware Co. 34
(I-8) Universal Oil Products Co. 50, 51
(I-9) Vapor Recovery Systems Co. 142
(J-1) Vogt Machine Co., Henry 32
(J-2) Warner Lewis Co. 143
(J-3) Warren Petroleum Corp. 49
(J-4) Western Supply Co. 91
(J-5) Wolverine Tube Div., Calumet & Hecla Inc. 118
(J-6) Wyatt Metal & Boiler Works ...Cover 4
(J-7) Yarnall-Waring Co. 27
(J-8) Zallea Brothers 18

WHAT'S NEW . . .



Automatic Multi-component Analyzer

A new instrument for automatic multi-component (as many as ten components) infrared analyses in the laboratory is now under development for a large processing company in the petroleum field. Future use is seen in petroleum and petrochemical companies.

Today, many laboratories must perform daily a large number of similar analyses of as many as nine or ten components in a single sample. Existing instruments, designed to handle a wide range of laboratory problems, are not sufficiently rapid in the simple job of gathering quantitative data. For example, some laboratories run four or five spectrometers or spectrophotometers around the clock to handle the job.

A number of problems hinder multi-component analysis today: unwanted portions of the spectrum must sometimes be scanned to reach the desired indicative wavelengths; the resulting spectra must be read, interpreted, and the ordinate data translated into series of simultaneous equations; these, in turn, must be solved with or without the help of computers; and, finally, the skills of laboratory technicians are inefficiently used by the attention such instruments demand during such analyses.

The proposed form of the instrument now being developed follows: Attached to a standard Perkin-Elmer Model 12 or 112 spectrometer (see diagram) is a control unit which sequences electromechanically through ten predetermined analytical wavelengths. At each point, first I_o and then L is automatically obtained by a cell in-cell out procedure.

Voltages proportional to their values are presented to an analog-to-digital converter from which data necessary to operate a read-out system are obtained. Any of a variety of read-out systems, such as the electric typewriter, Veeder counter, or card-punch system may be used. These values may then be fed into a computer for solution of the simultaneous equations.

Time required to cycle through one set of analytical wavelengths is expected to be approximately five minutes. The complete unit will consist of three major assemblies:

1—A table-model spectrometer.

2—A cabinet measuring 67¾ x 22 x 18 in., including a Leeds & Northrup recorder, a master control unit, a Perkin-Elmer modified Model 107 13-cycle amplifier assembly, and digitalizing equipment.

3—Another cabinet of similar dimensions including the wavelength and slit width selector panel, program control unit, and calibration control panel.

The operator selects the analytical wavelengths and corresponding slit widths by means of 20 multi-turn potentiometers on the master control panel. The selected wavelengths are then sequenced by the programming control unit. Zero can be set manually or it can be introduced automatically anywhere in the series as an eleventh cyclic point.

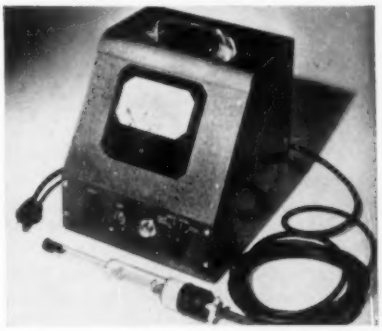
For calibration purposes, wavelength indexing and zero-setting check points may be selected by means of push buttons at the end of the automatic cycle.

The wavelength setting will reproduce to ± 0.15 cm^{-1} or ± 0.0015 microns at 10 microns. In terms of the numbered drum on the Model 112, this is ± 0.2 of the smallest drum division over the rock salt range. Slit width will reproduce to ± 1.0 microns or $\pm 1.0\%$, whichever is greater. The Perkin-Elmer Corp., Norwalk, Conn.

Circle No. **17** *on Reply Card*

For More Information

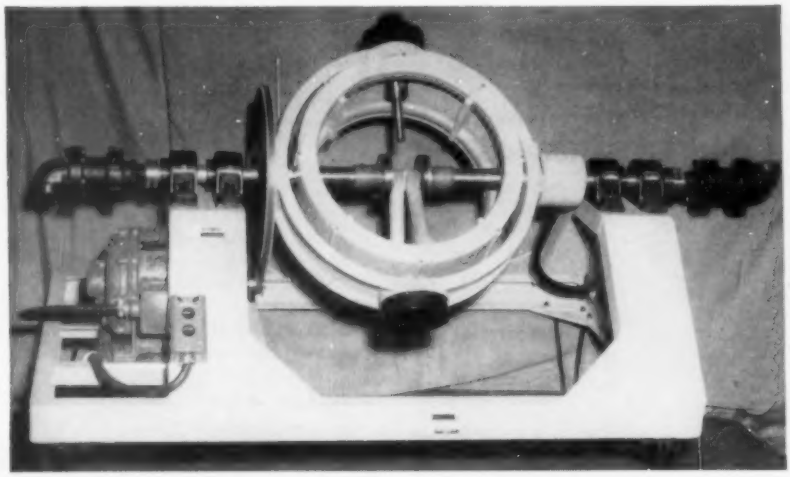
Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.

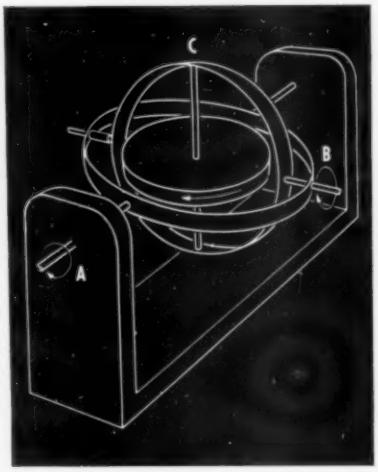


New Pirani Vacuum Gage Has Range from 1000 to 1 Microns

. . . or between 1.0 and 0.001 mm. Hg. The Model 516 has a low impedance power rectifier that eliminates the need for voltage adjustments during operation. One meter is used for both voltage adjustment and pressure reading. A compensating element inside the cabinet facilitates the installation and transportation of the gage; however, there is no loss of accuracy resulting from mounting the compensator inside the cabinet. Outgassing circuitry has been incorporated on the pressure range selector switch, permitting the outgassing at any pressure without danger to the filament. Gage cord is 10 ft. long, but cords up to 100 ft. may be used without loss of accuracy. Unit operates on 60-cycle, 110-volt, A.C. National Research Corp., 70 Memorial Drive, Cambridge, Mass.

Circle No. **18** *on Reply Card*





New Mass Flow Meter Uses Gyro Idea

An entirely new type of flow meter for measuring the mass of a fluid flowing through a line is being developed by Control Engineering Corp. Known as the "Gyro" Flow Meter, it operates on the principle of the gyroscope and measures quantity or rate of flow directly in terms of weight—rather than volume.

It can be applied to metering the flow of any fluid (gas, liquid, or a mixture of the two) and will also measure systems containing limited amounts of suspended solids. Since the meter measures mass, it is fundamentally independent of viscosity, temperature, pressure, or compressibility of the fluid being measured—the variables which have to be corrected for in volumetric type flow meters—and can be used with practically any fluid which can be pumped. In gas measurement it is expected to have particular application in systems operating under pressures of 20 atms. or greater.

Quantity and rate of throughput can be measured in whatever units of mass and time the meter is calibrated—e.g. lbs./min. and total pounds. Accuracy of ¼ th of 1% is claimed for the present design of the meter, and a possible accuracy of 1/10th of 1% is anticipated with further development.

Availability of commercial meters is not expected for another six months. First models to be produced will probably have a capacity of about 500 lbs./min., and are expected to cost in the neighborhood of $2,000 each. They will eventually be available in explosion-proof design, according to the company's engineers, and later models will have a capacity of 1000 lbs./min.

Applications in the petroleum processing industries include possible use in measuring LPG (which frequently exists in both the liquid and gas phases), in measuring specified quantities of materials by weight for blending operations, and to a limited extent in measuring fluidized solids.

How the meter works can best be explained by referring to the illustrations above—a photograph of the first demonstration model on the left and a sketch of a simple gyroscope on the right.

Referring to the sketch, as the gyroscope is rotated at constant speed about axis "A" and is spring-restrained about axis "B" while the gyro wheel is spinning about axis "C," a torque is produced about axis "B" which is proportional to the angular momentum of the gyro wheel.

To measure the mass flow of a fluid using this principle, the flowing stream is sent through a pipe formed into a circle, as shown in the photograph. The mass of material flowing through the circular pipe corresponds to the rotating gyro wheel. Therefore, using the flowing fluid in place of the gyro wheel and rotating the complete assembly about axis "A," the torque produced about the axis "B" is in direct proportion to the mass flow. Measuring the torque through a properly calibrated indicator will give a measurement of the mass of fluid flowing through the meter.

The original development work on the application of the gyroscope principle to flow metering was done about ten years ago by the late Dr. John M. Pearson of Sun Oil Co. It was patented in 1952. Control Engineering Corp. has further developed the first simplified gyro flow meter into a practical industrial instrument, under license from Sun, and has several improvement patents pending. Control Engrg. Corp., 570 Providence Highway, Norwood, Mass.

Circle No. **19** *on Reply Card*

New 'In-Line' Filter Resistant To Many Corrosive Materials

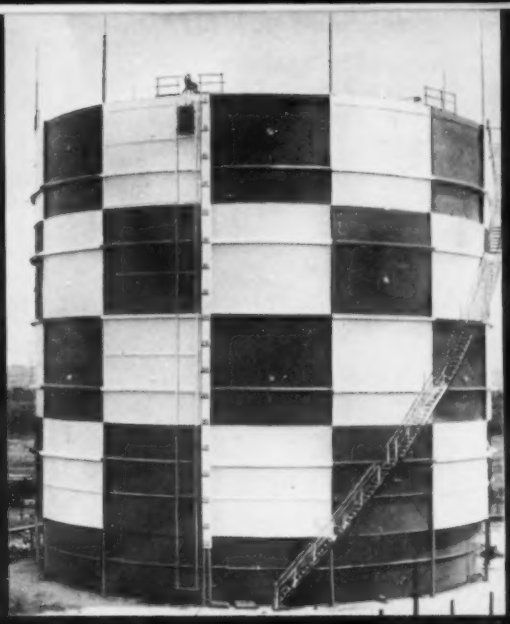
. . . such as fuming nitric acid, hydrogen peroxide, and hydrochloric acid. The filter medium is porous "Kel-F," the polytetrafluoroethylene plastic developed and now manufactured by M. W. Kellogg Co. The porous Kel-F presents a large surface area, yet it does not catalyze the decomposition of hydrogen peroxide. Standard elements will remove particles larger than five microns in liquid filtration, and much finer particles in gas filtration. It can be used at temperatures up to 350° F. and is resistant to thermal shock. It has a tensile strength of 900 psi. and a modulus of elasticity of 18,000 psi. The plastic element is housed in a stainless steel container. Other metals or alloys are available for handling materials corrosive to stainless steel. One model of filter provides a sq. ft. of filter area in an envelope 5⅜ in. in diameter and 6½ in. long. Disassembly and reassembly is fast with a few simple tools. Pressure drops are said to be very low. Units will withstand 75 psi. differential across the Kel-F element and up to 1200 psi. line pressures. Complete filters are available from fractional sq. ft. surface area up to 50 sq. ft.—larger units can be made on special order. Porous Plastic Filter Co., Glen Cove, N. Y.

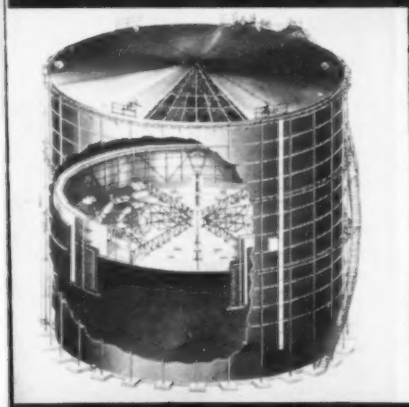
Circle No. **20** *on Reply Card*

simple! proved in use!

Wiggins Gasholder

BY GENERAL AMERICAN



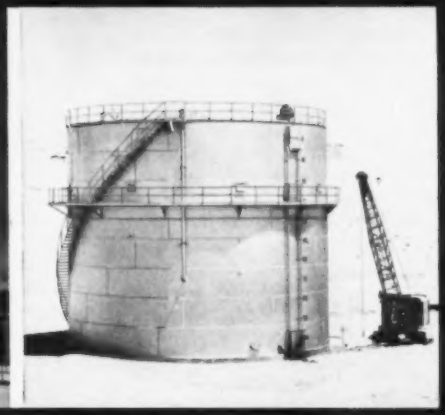


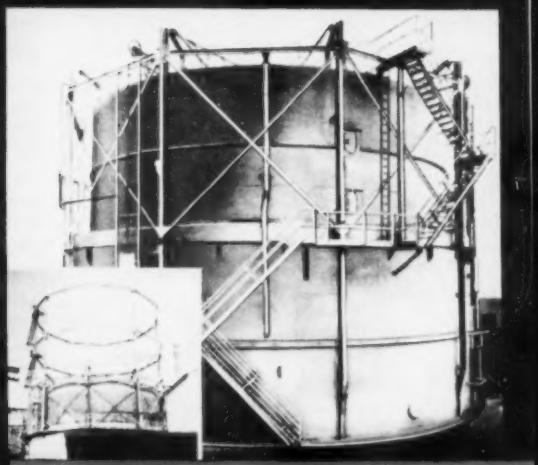
The only gasholder that uses

NO WATER
NO TAR
NO GREASE

The only gasholder that assures you

NO WEATHER WORRIES
NO OPERATING COSTS
NO MAINTENANCE PROBLEMS





GENERAL AMERICAN

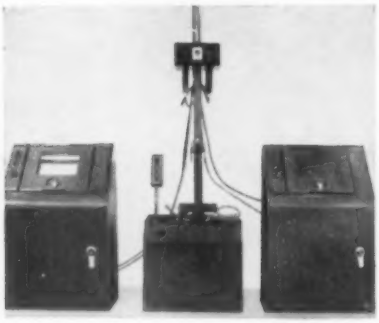
WIGGINS VAPOR SEALS
GENERAL AMERICAN
TRADE MARK

TRANSPORTATION CORPORATION

General Sales Office: 135 South La Salle Street
Chicago 90, Illinois
Offices in principal cities

You can convert your old style gasholders to get the Wiggins advantages

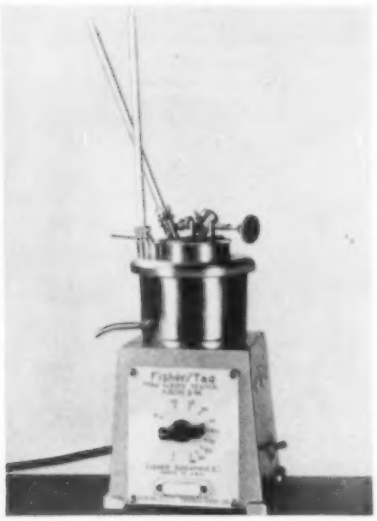
Be sure to get the performance record on the only modern gasholder before you plan any gasholder construction.



Wall Thickness and Roundness of Tubing Measured by Beta Rays

. . . in a new radioactivity-operated gage. High accuracy is claimed for gaging small diameter, thin-walled tubing. A source of beta radiation, moved inside the tube in relation to a sensitive detecting device on the outside constitutes the principle of operation. Changes in wall thickness affect the amount of radiation passing through the wall. These changes are translated into thickness readings and recorded on a chart. A completed gage is now in use at the Knolls Atomic Power Laboratory, operated by General Electric at Schenectady, N. Y. Tracerlab, Inc., 130 High St., Boston 10, Mass.

Circle No. **21** *on Reply Card*



Closed-cup Flash-point Tester Redesigned for Electric Heat

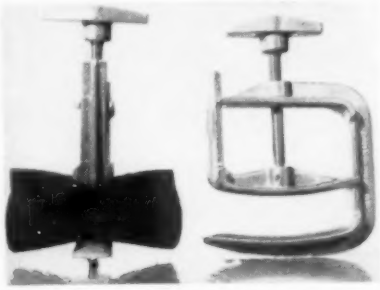
. . . and is a basic re-design of the "TAG" tester. The new "Fisher/Tag" meets specifications of ASTM D-56; ASA Z-11.24; Federal Specifications 110.0; API Standard 509; and has been adopted by various paint trade groups. Its 150-watt heater and variable-power transformer with reproducible setting supply the close control needed for the slow heating rate required by the ASTM D-56 test. It has aluminum plates to protect the heating unit against spillage and to distribute heat more effectively. There is also an inlet for circulating cooling water between determinations. This latter feature saves time in lowering bath temperature and permits lower-than-room temperature flash-point runs. The new design is available also in gas and alcohol heating models. A special metal floor holds the burners at the height and position necessary to maintain heating rates as required by the ASTM test. Fisher Scientific Co., 717 Forbes St., Pittsburgh, Penna.

Circle No. **22** *on Reply Card*

Clearance Gage Sets "Gap" On Overhead Valve Engines

. . . utilizing a new principle. The new P. & G. "Valve-Gapper" measures the travel of the valve rocker arm prior to contact with the valve stem. This is transmitted to a dial indicator graduated in 0.001 in. It permits a positive visual setting of valve clearance regardless of wear or pitting of the valve rocker arm. Hydraulic valve lifters can also be checked visually with this treatment. It is placed on the valve rocker and with the engine running, even a tiny gap will register. Models are now available for most gas and diesel engines with overhead valves. A special model has been designed for GM diesels. It includes possibility of its use to time injector and to balance fuel injector racks. In use for setting valve gap, the tool is positioned on the rocker arm with the base resting on the valve keeper, and the movable bracket hooked securely on the edges of the valve rocker arm. As the arm moves toward the valve stem, the bracket moves with it until contact is made. This movement is registered on the dial. As soon as the rocker arm contacts the stem, the entire tool moves downward with the valve. The only movement registered is that of the arm prior to contact with the valve stem. The Gapper leaves both hands free to handle adjusting tools. P & G Manufacturing Co., 2262 North Albina Ave., Portland 12, Ore.

Circle No. **23** *on Reply Card*



Pinch Type Device Designed For Valving on Hose Lines

. . . particularly where used for the transfer of corrosive liquids. The new "Camac" Hose Valve, because of a contoured design, will not damage the hose and will give complete shut-off against pressures up to 100 psi., according to the manufacturer. One handed operation is said to be possible and the valve may easily be put on or removed from the line without disturbing connections. Body of the valve mechanism is made of aluminum and bronze for weather protection. Valves are suitable for use with hose sizes from 1 to 2½-in. I. D. Carl Buck & Associates, Essex Fells, N. J.

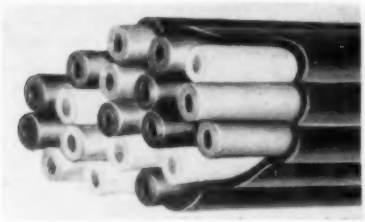
Circle No. **24** *on Reply Card*

Adhesive Developed for Binding Teflon to Itself or to Metal

. . . and a variety of other materials. Of the pressure sensitive type, the new adhesive is said to have good acid and alkali resistance and electrical properties. Tests have indicated a peel strength of over 1000 gms./inch or a direct pull of 12 to 15 psi. for Teflon to Teflon and Teflon to stainless steel. The material, "Flexrock No. 80", can be applied by brushing, dipping, or spraying. For small applications, brushing is reported to be adequate. Air drying is satisfactory but takes several hours, and this period can be reduced by heating for 15 to 30 minutes at about 210° F. Heating for 5 minutes at 300° F. will result in greater adhesive strength. Flexrock Co., Packing Div., 3602-T Filbert St., Philadelphia 1, Penna.

Circle No. **25** *on Reply Card*

What's New!



Instrument Tubing Harness Now Available with Color-coded Lines

. . . making installation as simple as in electrical wiring. It eliminates the necessity for the installer to identify individual lines by such means as applying compressed air to one end of a long run of tubing. "Impervapak Poly-Cor," available with 4, 7, 10, 14, or 19 tubes, has lines coded in black, red, blue, or green. Other colors can be supplied on special order. The harness consists of a bundle of polyethylene tubes over which has been extruded a 1/16-in. thick sheath of vinyl plastic. Samuel Moore & Co., Dekoron Tubing Division, Mantua, Ohio.

Circle No. **26** *on Reply Card*

New Transducer Converts Fluid Pressure to Proportional Volts

. . . in A.C., and with accuracy to within ±0.25% at any point. The "Dynaformer" Presure Cell is protected against overrange to 150% of its rating. Its output is measured in terms of pressure by the manufacturer's Electronic Resistance "Dynalog." The new cell consists of a Bourdon pressure spring linked to a copper ring which surrounds the iron core of a differential transformer. Responding to fluid pressure, the spring positions the ring, inducing a differential voltage in the output winding proportional to the fluid pressure. An adjustment permits the user to match the zero of the transducer to that of the instrument. Any

Before Rupture
After Rupture
Because our standard angular type seat is retained with this design, this disc may be used with any existing BS&B Safety Head flanges you may now have in service. Also available in a complete assembly consisting of inlet and outlet flanges, rupture disc, studs and nuts.

BS&B

Announces

A NEW DESIGN OF SAFETY HEAD RUPTURE DISC FOR LOW PRESSURE APPLICATIONS MODELS 1A AND 1B

Here is a new BS&B Safety Head rupture disc especially developed for low pressure applications of a type which, because of extreme corrosive conditions, cannot be handled by our standard pre-bulged type of disc.

As you know, the BS&B Safety Head is a patented pressure relief device that is designed to become an integral part of any pressured system containing air, gas or liquid—either bland or corrosive.

Disc Models 1A and 1B are constructed of corrosion resistant metals such as Inconel, stainless steel, nickel, Hastelloy B and Monel, using a sealing membrane of Teflon or Kel-F. Either model is available in 2", 3", 4", 6", 8" and 10" sizes. Pressure ratings range from 8 to 100 lbs. Close design tolerances are an inherent feature of this type of disc.

Our knowledge attained by years of experience in the rupture disc field, combined with continuing research, development and a wide selection of controlled ductile metals has again enabled BS&B to provide industry with a time-proven product.

If you have a pressure relief problem which you have not been able to solve satisfactorily with the pre-bulged type of disc or other types of relief devices, we suggest that you investigate the BS&B Model 1A or 1B disc.

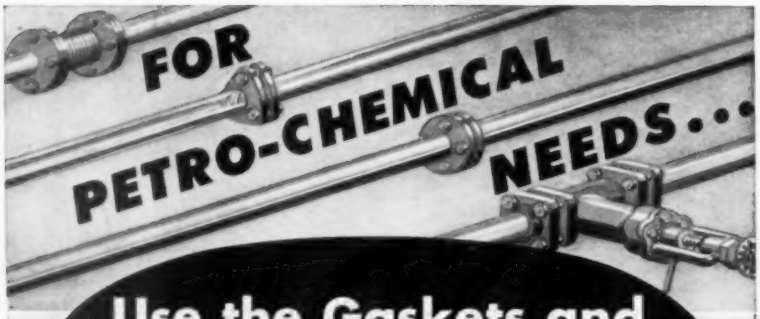
Your BS&B Man will be glad to give you details...or you may write for descriptive literature and prices.

BS&B Safety Heads

THE "CIRCUIT BREAKER" OF *Any Pressured System*

BLACK, SIVALLS & BRYSON, INC.
Safety Head Division, Dept. 2-D1
7500 East 12th St., Kansas City 26, Mo.

SAFETY BS&B HEADS OVER 60 YEARS



Use the Gaskets and Packing No Chemicals Can Attack

MADE OF TEFLON® duPont Trademark

CHEMISEAL V-RINGS

Select Chemiseal No. 810-V packing for valves. It provides necessary seal at low gland pressures and reduces valve torque because it is extremely anti-hesive. No lubricant is required for superior operation. Supplied in sets to meet specific requirements. Ask for Catalog No. 810-V.

CHEMISEAL PUMP PACKING

Select Chemiseal No. 711 packing for rotating or reciprocating shafts. It provides a low friction 2-way seal that not only prevents axial seepage, but also seals against shaft and stuffing box as well. Write for Catalog No. 711.

CHEMISEAL TEFLON-JACKETED GASKETS

Select Chemiseal No. 1-339 WA Teflon Jacketed Gaskets for all types of metal and special chemical resistant piping connections. Available in any size with a variety of filler materials suitable for stainless steel, glass, glass-lined steel, porcelain, Karbate, Haveg or other chemical piping and equipment. These fillers are protected on both faces and the inside diameter by the chemical resistant Teflon Jacket. Write for Catalog No. 1-339 WA.

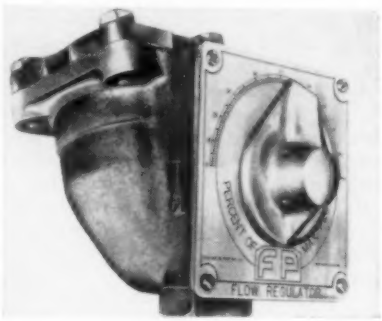
UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY

Representatives in Principal Cities Throughout the World

pressure range between 0 to 30 in. Hg. and 0 to 10,000 psi. is available. All parts are in a splashproof, rubber-gasketed, cast-aluminum case with pressure-tight cable connection. Electrical components, except the transformer coil, are embedded in plastic for moisture protection. Three lugs on the case permit the cell to be mounted in any position, or, if desired, directly on the pressure connection. The Foxboro Co., Foxboro, Mass.

Circle No. **27** *on Reply Card*



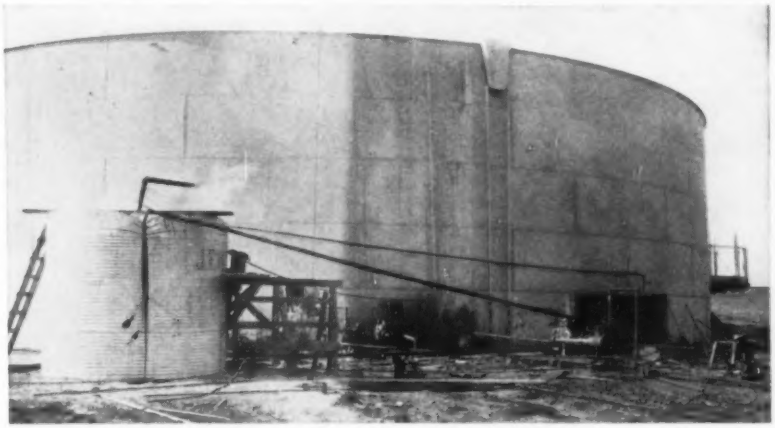
Flow Control Maintains Pre-set Rates Despite Pressure Changes

. . . either upstream or down. Low cost and automatic, it requires no outside energy source, operating entirely by the liquid passing through it. Suggested applications include such flows as: feeds to reactors or stills, reflux and drawoffs, heat exchangers. Its use is suggested where absence of dependable utility services or unjustifiably high costs prohibits electric or pneumatic systems; and/or as a cost-cutting substitute for conventional proportional or automatic reset type equipment in cascade electric or pneumatic systems. The new device maintains constant flow rate by maintaining constant pressure differential. In-line or panel mounting can be used for the regulator. Spring-loading permits mounting in any position. Direct manual and remote pneumatic setting arrangements are interchangeable without altering the standard body. Unit is available in ½, 1, and 2 in. sizes for flow ranges of 0.5-5, 1.0-15, and 6-80 gpm. respectively. Reproducibility of flow rates with a given dial setting will be at least ±3% over a pressure-drop range of 5-125 psi. Standard size models with screw-thread provisions for mounting are available in bronze or stainless steel. Fischer & Porter Co., 17 Jacksonville Rd., Hatboro, Penna.

Circle No. **28** *on Reply Card*

New Continuous H_2 Analyzer Useful in Catalytic Reforming

. . . with its detection range from 0.1 part per 10,000 up to 100% hydrogen. Principle of its operation is passage of the gas through a catalyst in which the hydrogen is quantitatively oxidized to water. Here's how it works. A specific amount of the hydrocarbon is withdrawn continually by the analyzer from the reforming stream, and is mixed with a given volume of air. Both the flow rate and volume of the sample, as well as of the air, is controlled accurately. This mixture then is filtered and enters the analyzing cell, inside a heating block. Temperature is kept constant in the cell by the block. The temperature differential resulting in the cell from the reaction by the catalyst with the mixture is detected by a set of thermopiles. Electrical output of the piles is recorded by a potentiometric recorder. Calibration is han-



80,000 barrel tank cleaned for less than $500

Oakite Composition No. 9 gets tank clean as new—saves time and money

It used to take 8 men from 2 to 3 weeks to scrape the interior of this 80,000 barrel tank clean. Could Oakite do it faster?

The Oakite Man suggested steaming the tank for 72 hours, then spraying all surfaces with a 1:2 mixture of Oakite Composition No. 9 and kerosene. After the solution had soaked for four hours, the tank was flushed with a high pressure hose.

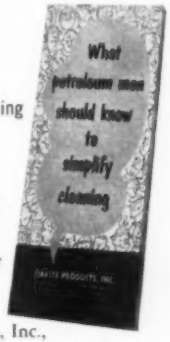
Results: Tank was as clean as the day it was built. The job took only 36 actual man hours. The cost, including materials, was under $500.

Proving that—in industrial cleaning it always pays to consult Oakite.

Call your Oakite Technical Service Representative. His experience is yours to draw on. He'll study your cleaning problem, suggest and demonstrate the best material and method. He'll keep checking back to see that you get top quality cleaning at low cost. Call him today!

FREE HANDBOOK—full of facts on

- Drum reconditioning
- Descaling
- Cleaning tanks
- Salvage cleaning
- Paint stripping
- Cleaning tank car interiors

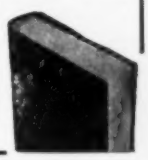


Write Oakite Products, Inc., 50D Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE
Technical Service
petroleum service division
Representatives in Principal Cities of U. S. and Canada

PRACTICAL OIL GEOLOGY

A clear, concise, and practical book that shows how geology can aid in finding and developing natural gas and petroleum. Covers the fundamentals of geology . . . methods of searching for gas and oil in new areas . . . selection of sites . . . the application of geology in drilling . . . plus a wealth of other facts for the use of the driller, operator, and mining engineer. By Dorsey Hager, Consulting Geologist and Petroleum Engineer. 6th Ed. 589 pp., 227 illus., 78 tables, $8.00



Petroleum Production Engineering

OIL FIELD EXPLOITATION

A thoroughgoing description and analysis of methods and devices for promoting production efficiency in the oil industry—from completion of wells to transportation of the products to market. Covers the engineering and technological problems . . . contains much in the way of practical, factual data . . . and covers the entire production phase in a readable style. The book is valuable to everyone seeking an orderly review of principles, methods, and equipment used in recovering petroleum. By Lester C. Uren, Prof. of Petroleum Engr., Univ. of Calif. 3rd Ed. 807 pp., 367 illus., $10.00

Petroleum Production Engineering

PETROLEUM PRODUCTION ECONOMICS

Designed for engineers, this book covers all important aspects of petroleum engineering economics and business administration. It provides a clear explanation of the principles of economics as they apply to the petroleum-producing industry. Such topics as oil and gas land acquisition and control . . . labor management . . . oil-industry taxation, etc., are all clearly covered. By Lester C. Uren, 639 pp., 117 illus., $8.00

Petroleum Production Engineering

OIL FIELD DEVELOPMENT

A review of the fundamentals, problems, methods, and equipment—for all interested in a broad, practical understanding of petroleum production—covering all the steps up to the point at which the wells are ready to produce. Describes general factors of developing the field . . . drilling . . . casing . . . finishing the well . . . oil field hydrology . . . with particular emphasis on improved methods of deep well drilling. By Lester C. Uren, 3rd Ed. 764 pp., 321 illus., $8.50

SEE THESE BOOKS 10 DAYS FREE

McGRAW-HILL BOOK CO., INC.
330 W. 42nd St., NYC 36

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus a few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

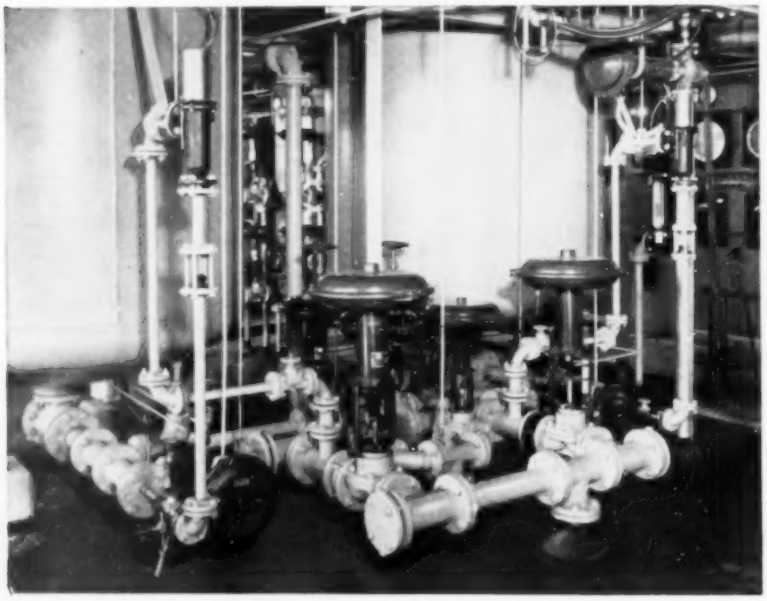
- ☐ Hager—PRAC. OIL GEOL. $8.00
- ☐ Uren—OIL FIELD EXPLOITATION 10.00
- ☐ Uren—PETROLEUM PRODUCTION ECONOMICS 8.00
- ☐ Uren—OIL FIELD DEVELOPMENT 8.50

(print)
Name .....
Address .....
City ..... Zone..... State.....
Company .....
Position PET-1

This offer applies to U.S. only.

CORROSIVE LIQUIDS CAN'T HURT THIS INSTALLATION

Large midwest corn processor installs SARAN lined pipe, fittings and valves



When one of the largest processors of corn in the midwest was faced with the problem of handling corrosive liquid safely and efficiently in an ion exchange system, they investigated saran lined pipe and fittings.

They learned that saran lined pipe fittings and valves assure tight, leakproof joints. They were convinced that the excellent corrosion resistance of strong, rigid saran lined pipe would mean longer service and greater dependability. The sum total of advantages offered by saran lined pipe indicated that it would meet the company's demands for equipment that would assure uninterrupted processing free from the expense and inconvenience of unscheduled "shutdowns." Wherever piping with unusual resistance to most chemicals and solvents is involved, install saran lined steel pipe. It can be easily cut and threaded in the field without need for special tools or handling; costly downtime can be reduced to a minimum. We'll be glad to assist you with installation plans. Write or call the Saran Lined Pipe Company, Ferndale, Michigan. Offices in New York • Boston • Pittsburgh Tulsa • Philadelphia • Chicago • Portland • Indianapolis • San Francisco Houston • Salt Lake City • Los Angeles Seattle • Cleveland • Charleston, S. C. Toronto • Montreal

Saran Lined Pipe Company 11630
2415 Burdette Ave., Ferndale, Mich.

Please send me a copy of your catalog on Saran Lined Pipe, Valves and Fittings.

Name_____

Title_____

Company_____

Address_____

City_____ State_____

• • •

RELATED SARAN PRODUCTS

Saran rubber tank lining • Saran rubber molding stock • Saran pipe and fittings Saran tubing and fittings

SARAN LINED PIPE COMPANY

2415 BURDETTE AVENUE, FERNDALE, MICHIGAN

dled by passing gas with a known hydrogen concentration through the instrument. The complete analyzer is shipped mounted on a panel 6 ft. 4 in. high x 5 ft. 4 in. wide. Recorder is shipped separately for mounting on customer's panel; however, a recorder panel is also available as optional equipment. Flow rate of the sample stream is about 100 cc./min.: for the air stream about 10,000 cc./min. Taller & Cooper, Inc., 75 Front St., Brooklyn 1, N. Y.

Circle No. **29** *on Reply Card*

New Regulator Controls Flow Of Liquids with Light Solids

. . . as well as clear liquids. The Kates "Type SA" Regulator will handle light slurries, many suspensions, hot tar solutions, and other similar materials, in spite of fluctuations in either inlet or outlet pressure. A down-flow design provides self-cleaning, prevents clogging and blocking by solids, and provides for complete drainage of the regulator when the piping system is drained. No air lines, pressure regulators, air filters, seal pots, or other mechanisms are used. Time lag and hunting for the set point are said to be eliminated. The Type SA is available in two constructions: steel casing with stainless steel trim and valves, or Type 316 stainless steel throughout. Capacities range from 2 to 10 gpm. for No. 1-SA and to 100 to 550 gpm. for the No. 7-SA. The unit is said to be applicable for use in automatic control systems, for remote operation, or for operation cooperatively with other equipment. W. A. Kates Co., 430 Waukegan Rd., Deerfield, Ill.

Circle No. **30** *on Reply Card*

CONTAINERS
- Cylinders
- Ton Drums
- Tank Trucks
- Tank Cars

If you use the SO_2 extraction process — then you will want to use Tennessee's highest quality SO_2. You'll do the job better — You'll do it more economically.

For detailed information, phone, wire or write . . .

TENNESSEE CORPORATION

617-29 Grant Building, Atlanta, Georgia

Pure zinc or aluminum, molten-sprayed on iron or steel surfaces, provides complete, dependable protection against atmospheric corrosion for upwards of 20 years without further maintenance. Such coatings are *mechanically* bonded to the surface—adhesion is *not* dependent on volatile vehicles or binders. Scaling, crazing, blisters, are eliminated. Protection is positive. "Metallize 'em and forget 'em!"

Why not find out more about how you can forget rust for 20 years or more? For descriptive Bulletin 62B—or the name of your nearest Metco Systems contractor—write or wire .

**Reg. U.S. Pat. Off.*

the Metco* Systems
—a series of 18 basic engineering specifications developed over 19 years of experience with pure zinc and aluminum coatings on many different types of structures and equipment. The *Metco Systems* provide for standardization of surface preparation, metal coating thicknesses and organic aftercoatings for various service conditions and appearance requirements.

Metco Systems Dept. PP, 38-14 30th Street Long Island City 1, New York

4½" DIAL THERMOMETERS

Made in 3 types to suit any requirements. Rigid stem, wall or flush mounted, 11 inches of scale reading. Interchangeable with standard industrial separable sockets. Stem can be placed at any angle and case can be rotated to any readable position.

PALMER
MERCURY ACTUATED
Temperature Indicating Instruments

RECORDING THERMOMETERS

Twelve inch die-cast aluminum case with black or white wrinkle or satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges —40 +950°F or Equivalent in °C.

INDUSTRIAL THERMOMETERS

Red-Reading Mercury —Extruded brass case — chrome finish. Ranges —40 + 950°F or Equivalent in °C.

RED-READING MERCURY LABORATORY THERMOMETERS

Thoroughly annealed for permanent accuracy. Complete line A.S.T.M. and fractional division types.

FOR COMPLETE INFORMATION WRITE FOR CATALOG 200 G

PALMER
THERMOMETERS, INC.
Cincinnati 12, Ohio • MElrose 1500

New Totally-enclosed DC Motor Has Use in Severe Atmosphere

. . . conditions, and is available in ratings from 15 to 200 hp. It is said to have 50% greater heat transfer in a 37% smaller unit than previous designs. Compact cooling units, mounted completely within the over-all dimensions of the motors, permit operation at extremely low speeds for long periods of time, because the ventilation has been made independent of motor speed. A double system of blowers are driven by the manufacturer's standard totally-enclosed motors, operating on 3-phase, 60-cycle power supply. The blower controller consists of a simple magnetic switch which can, at a slight additional cost, be interlocked with the main controller so both are started simultaneously. A thermostatic relay protects the main motor in case of blower-motor failure. Relay contacts can be arranged to cut off the main motor or sound an alarm. Located at the commutator-end air duct, the operating mechanism is accessible from the outside. General Electric Co., Schenectady 5, N. Y.

Circle No. **31** *on Reply Card*

Rigid Plastic Pipe and Fittings Is 20% of the Weight of Steel

. . . pipe of the same size. Alpha Plastics, the manufacturer, makes it from polyvinyl chloride resin plastic produced by B. F. Goodrich Chemical Co. It is also considerably lower in cost than corrosion-resistant metal pipe. Industrial stainless steel pipe comparable to the same sizes in plastic would cost $2.24/ft., while the plastic costs 51¢/ft. The new slip-sleeve fittings are cemented to the pipe with a solvent cement which is applied by brush, permitting fast installation. Connections are equal in strength to the parent material. In addition, it is said the smooth, hard surface of the pipe has low flow resistance, making possible smaller diameter lines than with metal pipe. Alpha Plastics Inc., West Orange, N. J.

Circle No. **32** *on Reply Card*

Trade Literature

Analyzer for Tetraethyl Lead

. . . in gasoline, the new Fisher "TEL-Meter"; *Bulletin FS-235* provides complete data on this direct reading, push-button, polarographic laboratory instrument; including a copy of the proposed ASTM method for polarographic determination of TEL in gasoline. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **33** *on Reply Card*

Industrial Filters

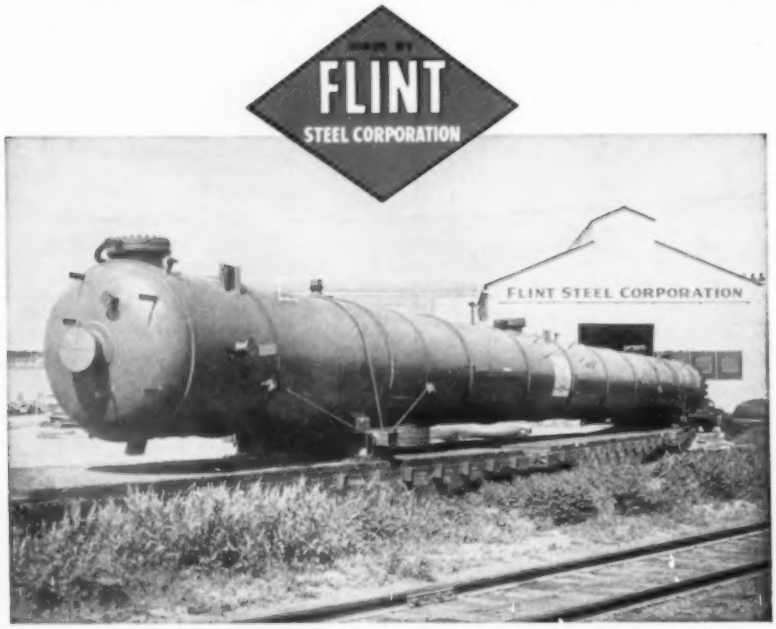
. . . for microscopic clarification of liquids and various gases; new condensed catalog gives dimensions, specifications, and other pertinent data. Commercial Filters Corp., Melrose 76, Mass.

Circle No. **34** *on Reply Card*

Petroleum Processing Index

. . . for 1953; including subject and author indexes for all feature articles and regular departments for the 12 issues of this magazine published during the past year. Available in the next few weeks, but you can order now from McGraw-Hill Petroleum Publications, 330 West 42nd St., New York 36, N. Y., or . . .

Circle No. **35** *on Reply Card*



TULSA TYPE

OIL REFINERY EQUIPMENT
Natural Gasoline Plant Equipment
Chemical Processing Equipment

•

Tulsa Type Equipment is designed and fabricated to meet your specified operating conditions.
Write for general catalog

FLINT STEEL CORPORATION
TULSA, OKLAHOMA

What's New!

Catalytic Reforming

. . . by new Baker-Sinclair process; set of brochures on the subject of selective hydrogenation by the platinum metals catalysts. Baker & Co., Inc., 113 Astor St., Newark 5, N. J.

Circle No. **36** *on Reply Card*

Force-balance Type Positioner

. . . for cylinder-operated devices requiring high power and long stroke, such as large control valves, large dampers, and variable speed mechanisms; *Bulletin 473* on the "Poweractor." The Foxboro Co., Foxboro, Mass.

Circle No. **37** *on Reply Card*

More Service from Pump Rods

. . . by use of metallizing techniques; one of several articles in *Metro News, Vol. 6, No. 11.* Metallizing Engineering Co., Inc., 38-14 30th Street, Long Island City 1, N. Y.

Circle No. **38** *on Reply Card*

Analog Computors

. . . described in a 20-page, pocket-size booklet, with charts, and photographs, a reprint of a paper from 1953 Instrument Conference. George A. Philbrick Researches, Inc., 230 Congress St., Boston 10, Mass.

Circle No. **39** *on Reply Card*

Tube Expanders

. . . their construction and operation; data on sizes, weights, and dimensions; instructions for ordering for specific applications; and a supplemental price list; *Form No. R-100.* J. Faessler Mfg. Co., Moberly, Mo.

Circle No. **40** *on Reply Card*

The Electron Microscope

. . . in the petroleum industry, a subject covered by a 10-page article comprising the entire December, 1953, issue of *Lubrication,* a technical publication of The Texas Co., 135 East 42nd St., New York 17, N. Y.

Circle No. **41** *on Reply Card*

Index Setting Devices

. . . of both fixed and adjustable types, for automatic remote setting of pneumatic controllers; detailed description, typical applications, engineering data; *Indexet Mechanisims Bulletin 8930.* Minneapolis-Honeywell Regulator Co., Industrial (Brown Instruments) Division, Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **42** *on Reply Card*

ALWAYS a good job well done...

with AIRETOOL tube cleaners and expanders

For really effective tube cleaning in any refinery unit, tools must have power—power to rapidly and efficiently remove hard-rock coke deposits. AIRETOOL high speed motors have that power. Ball bearing thrusts at both front and rear assure constant torque at all speeds—loaded down to as low as 50 RPM, they will not bog down or stall! All AIRETOOL motors are tough but still easily maintained; all parts are ground to a slip-fit requiring no special tools. See how easily you can save time and money on tube maintenance; write to The AIRETOOL Manufacturing Co., 336 S. Center St. Springfield, Ohio.

AIRETOOL series "6000" ball bearing motor, shown with single expansion type cutter head for thoroughly cleaning coke from straight tubes.

There's an AIRETOOL TUBE CLEANER and TUBE EXPANDER for Every Type of Tubular Construction

Solve tube expansion problems

For accurate, consistent rolling of condensers or heat exchangers, tube ends, AIRETOOL Tube Expansion System automatically rolls joints to uniform and maximum tightness, eliminating all possibilities of over-expansion of tubes and distortion of tube sheet.

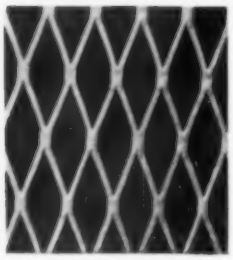
AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

Representatives in principal cities in U.S.A., Canada, Mexico, South America, England

Branch Offices: New York, Tulsa, Philadelphia, Houston, Baton Rouge, Chicago, Hudson Heights, N. J.

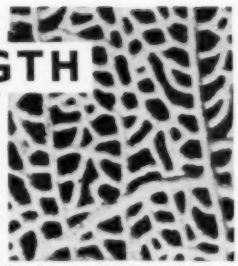
SAFETY AND STRENGTH

IN NATURE & IN INDUSTRY



Here's an expanded metal mesh that's widely used in industrial plants for safety and strength.

Industrial Plant fabrics, like fabrics in nature, must be suited to their purpose. Half a century of engineering and fabrication in many industrial fields have taught us how to suit steel and iron to your purposes. For steel buildings or barges, for tanks and pressure vessels, for structural steel in sheet, beam, plate or girder, write, wire or phone us. Wide engineering and fabricating experience in the following industries:



Here's a strong undersea sponge structure that also serves as a safety screen. Small fish are screened safely from pursuing larger fish, as they pass easily through its opening.

RICE SALT

SUGAR FISH

TUNG SULPHUR

PETROCHEMICALS

WATER TRANSPORTATION

What's New!

Steel Container Directory

. . . for 1953-1954, covering about 95%-vol. of the total industry production; with data on manufacturers of all types and sizes of drums, pails, and the like. Steel Shipping Container Institute, 600 Fifth Ave., New York 20, N. Y.

Circle No. **43** *on Reply Card*

Corrosive Liquids Feeder

. . . built of polyvinyl chloride plastic; for handling sulfuric, hydrochloric, and nitric acids; at standard flow rates of 1 to 10 gal./day, or on up to 25 gal./hr.; four-page folder, *Bulletin 541.* The Clarkson Co., 564 Market St., San Francisco 4, Calif.

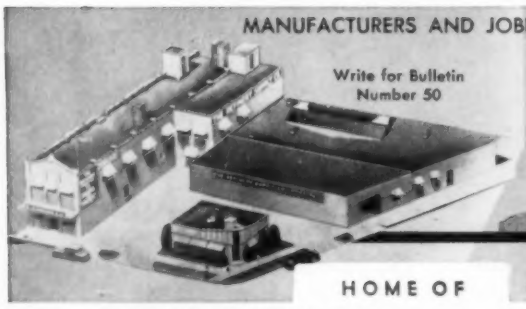
Circle No. **44** *on Reply Card*

Two-Use Detector

. . . for both liquid level and air flow, operated electrically on the principle of heat transfer; 16 pages of description of operation, specifications (including response curves on performance, operation, and electrical characteristics); *The Detect-A-Flo.* Fenwal Inc., Ashland, Mass.

Circle No. **45** *on Reply Card*

MANUFACTURERS AND JOBBERS OF **SCIENTIFIC INSTRUMENTS**



Write for Bulletin Number 50

HOME OF **Ac-Me & R. S. SPECIALTIES**

Ac-Me RECORDING GRAVITOMETER
Ac-ME SPECIFIC GRAVITY GAS BALANCE
Ac-Me PRESSURE VACUUM PUMP
R. S. MERCURY CLEANER
R. S. MANOMETER
R. S. DEAD WEIGHT GAUGE
R. S. DEAD WEIGHT TESTER
R. S. ORIFICE WELL TESTER
R. S. MOISTURE TESTER
R. S. FLAT BORE YEL-O-BAK THERMOMETERS
R. S. STREAMLINED HYDROMETERS
R. S. PULSAMETER
R. S. PRESSURE HYDROMETER JARS
R. S. VAPOR PRESSURE BOMB
R. S. DIAMOND CORE DRILL
R. S. THERMO PLUMB BOB THERMOMETERS
R. S. SUPER PRESSURE CONSISTOMETER
R. S. SMOKE METERS

COMPLETE LINE OF SCIENTIFIC LABORATORY EQUIPMENT INCLUDING CENTRAL SCIENTIFIC SPECIALTIES

cenco

Cenco . . . one dependable source of supply for everything you need in scientific instruments and laboratory supplies. Over 15,000 items . . . 14 branch offices and warehouses.

R.S.C.

REFINERY SUPPLY COMPANY
621 EAST FOURTH STREET • TULSA 3, OKLAHOMA
2215 McKINNEY AVENUE • HOUSTON 3, TEXAS

CENTRAL SCIENTIFIC COMPANY
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

What's New!

Differential Pressure Transmitter

. . . as a primary element designed to operate with the "Autronic" controlling and recording system; engineering data and specifications, and description of operation, *Bulletin A-707-A*. The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio.

Circle No. **46** *on Reply Card*

Synthetic Organic Chemicals

. . . and their physical properties are covered in the new 1954 edition of a 20-page, annual booklet; data on more than 330 products and 36 new chemicals; presented in easy-to-use tabular form. *PPSOC Booklet F-6136*. Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y.

Circle No. **47** *on Reply Card*

Crude Oil Treaters

. . . of the horizontal type, manufacturer's Model HGT; a 20-page catalog *No. 31-101* lists capacities and specifications, tells how to size the treater, gives one case example; photographs, charts, and diagrammatic drawings. Black, Sivalls & Bryson, Inc., 7500 East Twelfth St., Kansas City 26, Mo.

Circle No. **48** *on Reply Card*

Plastic Piping

. . . now being produced as a new product by Republic Steel; 12-page catalog, *No. Adv. 603*; tells why the firm entered the plastic pipe field, the two principal types of plastic pipe being made; how to join plastic pipe; with engineering and corrosion data. Republic Steel Corp., Advtg. Div., 3100 East 45th St., Cleveland 27, Ohio.

Circle No. **49** *on Reply Card*

Pipe Information

. . . including dimensions, weights, specifications, grades, and analyses on carbon, alloy, and stainless steel seamless and welded pipe; *Technical Data Card TDC 138 A*. Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Penna.

Circle No. **50** *on Reply Card*

Weld End Specifications

. . . for steel valves for high-pressure, high-temperature service, in sizes up to 2-in. on socket welds, and 2½ to 16 in. on butt welds, with diagrams indicating standard preparation; *Bulletin 507*. Edward Valves, Inc., East Chicago, Indiana.

Circle No. **51** *on Reply Card*

accurate instrumentation need not be costly

here's proof . . . Accurate to ± 1% of full scale, this Fielden TEKTOLOG Electronic Recorder has a sensitivity of ± 0.1% and reproducibility of ± 0.5%. Yet it sells at a price substantially below that of servo-operated potentiometer-type recorders!

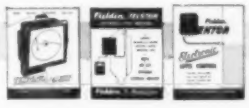
Reason: *Simplified* design, circuitry and construction. TEKTOLOG's recorder mechanism consists of only 4 principal units. By stressing *simplicity*, Fielden can bring you *all the accuracy you need* for most applications—without extra charges for marginal precision.

If simplified, practical instrumentation appeals to you, write us today for full details. There's no obligation.

DOLLAR FOR DOLLAR—YOUR BEST INSTRUMENT VALUE

Fielden

INSTRUMENT DIVISION



ROBERTSHAW-FULTON CONTROLS COMPANY
2920 N. 4th St., Dept. K, Philadelphia 33, Pa.

Send full details of Fielden simplified ☐ TEKTOLOG Electronic Recorders
☐ TELSTOR Electronic Level Indicator ☐ TEKTOR Electronic Level Control

*Name*_____

*Title*_____

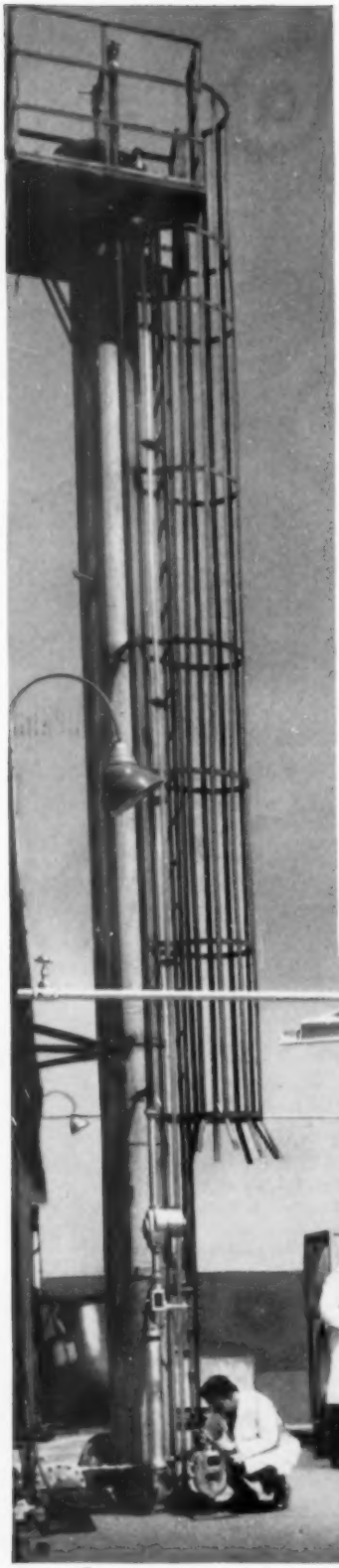
*Company*_____

*Address*_____ *City*_____ *State*_____

Fielden TEKTOR Electronic Level Control

Fielden TELSTOR Electronic Level Indicator

(To obtain more data on advertised products see page 128)

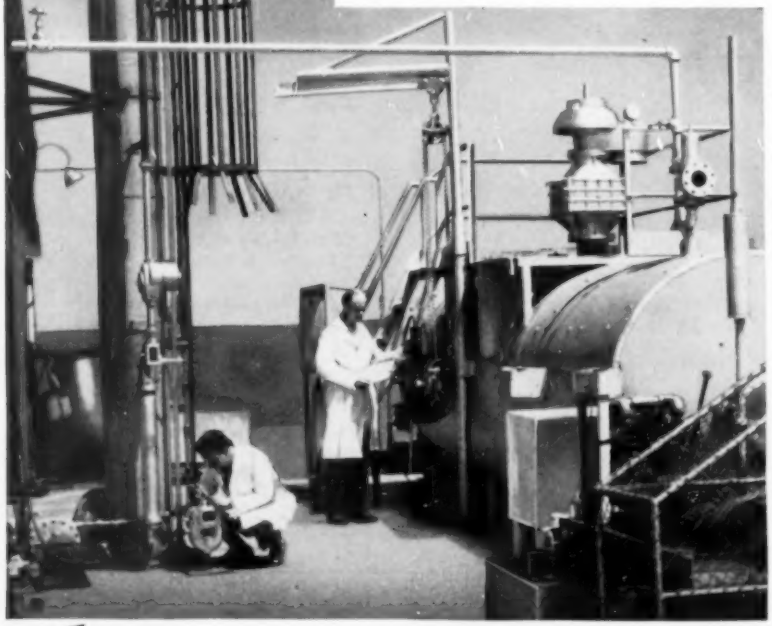


"Varec" meets the Challenge of Obsolescence!

The PETRO-CHEMICAL INDUSTRY is a dynamic one—continuously changing and constantly expanding to boost output and produce better products. This creates a high rate of obsolescence that demands new equipment designs and new material applications for replacements.

Vapor Recovery Systems Company is timing its production to meet this demand. Our Engineering department is continually testing new and better designs, seeking the finer quality parts, and adopting the most corrosive-resistant materials available to contribute to the progress of industry.

Whether you are installing or improving your TANK EQUIPMENT—GAS CONTROL DEVICES—GAUGING SYSTEMS, you'll find the "VAREC" line prepared to do the job in a better way.



"Varec" PROVED and APPROVED

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 NORTH ALAMEDA STREET • COMPTON, CALIFORNIA
Manufacturers of "VAREC" Equipment
Representatives in Principal Cities of the World

What's New!

Temperature Control Systems

. . . explained in a new educational booklet explaining various types, ranging from two-position "on-off" to proportional positioning with automatic reset; information of help in the selection of primary sensing elements; *Bulletin F 6149*. Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill.

Circle No. **52** *on Reply Card*

Plant Modernization, Expansion

. . . and basic planning for it is the subject of a new 16-page study, outlining a detailed step-by-step procedure covering this fundamental problem; second in a series of "aids to management" brochures. Walter Kidde Constructors, Inc., 140 Cedar St., New York City.

Circle No. **53** *on Reply Card*

Construction Information

. . . covering petroleum, petrochemical, and chemical fields; with illustrations and descriptions on gasoline plants, refineries, petrochemical processing plants, catalytic cracking units, and compressor stations; a 24-page brochure, *General Catalog No. RC-8523*. The Fluor Corp. Ltd., 2500 S. Atlantic Blvd., Los Angles, Calif.

Circle No. **54** *on Reply Card*

Rust Preventive Coatings

. . . covered as a complete line in new 20-page, 1954 general catalog on Rust-Oleum; includes instructions on surface preparation and coating application, 94 color chips of the various products, and a two-page question-and-answer section; *Form No. 253*. Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill.

Circle No. **55** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of PETROLEUM PROCESSING to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item. Then fill in the rest of the card and drop it in the mail. No postage is required.

✔ Check the advantages of Durametallic Packings

✔ IS IT LUBRICATED THRUOUT - AND WEARS LIKE A BEARING ?	Yes
✔ WILL IT OPERATE WITHOUT SCORING SHAFTS, SLEEVES OR STEMS ?	Yes
✔ IS IT PRECISION MADE - READY TO INSTALL IN MY STUFFING BOX ?	Yes
✔ ARE THERE TYPES AND STYLES FOR SEALING SPECIFIC CONDITIONS ?	Yes
✔ IS IT ECONOMICAL - CAPABLE OF LONG UNINTERRUPTED RUNS . . . ?	Yes

Prove this to yourself on your own equipment. Write for information on special types and styles of Durametallic Packings for your sealing needs. Ask for Bulletin No. DMPP. Durametallic Corporation, Kalamazoo, Michigan.

Send for descriptive bulletin CT-102

EXCEL-SO

CALIBRATING TANKS

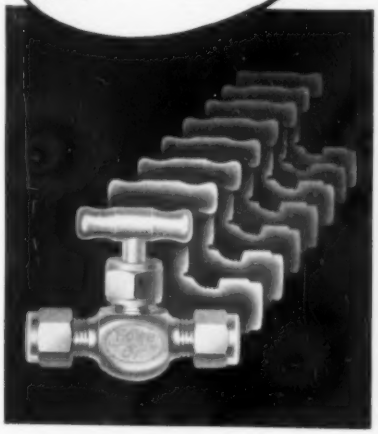
for

REFINERIES
TERMINALS
PIPE LINES
TANK TRUCKS
LOADING RACKS
PUBLIC SEALERS

We have built hundreds of these provers in all capacities from 50 gallons to 50 barrels. . . . This experience enables us to deliver a REAL PRECISION INSTRUMENT that is Guaranteed. Building, calibrating and guaranteeing a calibrating tank is specialized, painstaking work and is definitely "out" of the price-per-pound category. These tanks are designed to conform to the A.P.I. tentative code #1101, but may be furnished with such modifications as you, the customer, may require.

WARNER LEWIS COMPANY
BOX 3096 • TULSA, OKLAHOMA

What! No pipe threads?



HOKE VALVES WITH Swagelok® ENDS

Now they are available from stock at Crawford Fitting Company and all Swagelok Distributors. These valves, manufactured by Hoke, Incorporated, Englewood, N. J., are equipped with Swagelok ends to provide leakproof and torque-free seals on every type of instrumentation installation. The arrow on the valve body shows direction of flow.

Hoke valves equipped with Swagelok ends are made in brass, aluminum, steel and stainless steel in sizes to meet your requirements. For further information and Swagelok catalog address Department 69.

Here's how the Swagelok fitting functions.

CRAWFORD FITTING CO.
884 East 140th Street Cleveland 10, Ohio
Teletype CV-785

(To obtain more data on advertised products see page 128)

EDITORIALS . . .

FPC Must Regulate Sales Prices Of Gas in Interstate Commerce

FURTHER expansion of the natural gas industry may have been given a serious set-back by the Supreme Court action Nov. 30 on rate jurisdiction of the Federal Power Commission.

There now can be no further doubt that the FPC has the authority to regulate the price charged by a producer, Independent or otherwise, in the sale of natural gas to an interstate pipe line. Furthermore, FPC *must* regulate such rates. This is the meaning of the Court's refusal to hear an appeal in the so-called "Phillips Case," brought because FPC held it had no jurisdiction over prices in Phillips Petroleum Co.'s sales of natural gas to Michigan-Wisconsin Pipe Line Co.

The Court's refusal upholds a lower court decision that, because Phillips sells gas to a pipe line company operating in interstate commerce, the price does come under FPC's regulatory authority despite Phillips' showing it is a producer and gatherer. Three years ago, when the Phillips Case was launched, this ultimate effect was forecast by numerous members of the oil industry and feared by many more.

There also were those who then and now believe that FPC's apparent change of heart to stop legislating by decree, in which it has been upheld by several previous Supreme Court decisions, was merely a smoke-screen to cut the ground from under legislation spelling out Congress' original intent to exempt producing and gathering of natural gas from provisions of the Natural Gas Act. They averred it was FPC's strategy to have the Supreme Court order it to take jurisdiction in rate matters as exemplified in the Phillips Case.

Setting a price at which natural gas can be sold most certainly will have a far-reaching effect on producing and gathering operations. Set that price low enough and production and gathering will cease so far as "new" gas is concerned. Large reserves are still withheld from the market because owners fear, with justification, the stifling effects of FPC regulation and ultimate regimentation of the oil industry.

There have been many "voices in the wilderness" repeatedly declaring that the only sure way to enforce the intent of Congress in the Natural Gas Act, as amended, is to amend it again or write a new one. The last attempted amendment ended in a presidential veto. Now that there is at last a new Administration, perhaps these "voices" will take heart and try again.

—D.P.T.

Code For Flammable Liquids

THE National Fire Protection Assn. is to be congratulated for efforts now under way to prepare uniform classifications and methods of testing for flammable liquids. Apparently there are almost as many different sets of regulations classifying flammable liquids and specifying methods of tests as there are regulatory bodies having jurisdiction over these materials at the various local, state, national and international levels.

The resultant is said to be a most confusing mass of conflicts, unnecessary or impractical restrictions and sources of unwarranted expense to oil and chemical companies which must live with this tangle.

Unfortunately, when concerned business organizations protest against proposed regulations, they may be regarded as "pressure groups" with the prime purpose to save themselves money regardless of the public interest.

It is particularly fitting that a wholly independent organization having a diversified membership, like the NFPA, should undertake to develop a series of recommended practices for classification and testing procedures to supplant those now in effect.

The subcommittee of NFPA now starting the study will have the benefit of the combined technical brains of the organization and a host of industrial experiences which few regulatory bodies would have available. Such a uniform set of rules as should eventually result from the subcommittee's study will benefit all concerned, particularly the chemical and petrochemical industries due to the flammable nature of their many products.

—D.P.T.

New Service Stripes for Oil

THERE has never been a better example of government and industry working together for the common good than that of the Petroleum Administration for Defense.

The same words could have been said of the Petroleum Administration for War, which functioned through World War II, and of its predecessor during the first World War, when the petroleum industry served the nation through a division of the government's Fuel Administration.

The industry, through three national crises, has set an exemplary pattern for efficient functioning to meet wartime and civilian needs, under government supervision but without giving up the right of its members to function on their own initiative except as required to see that emergency requirements for petroleum products were fully met.

For these and other accomplishments of PAD, the thanks of the nation are due to Bruce K. Brown, J. Ed. Warren and Joseph A. La Fortune, who guided it through the years after the outbreak of war in Korea.

The National Petroleum Council has recommended that PAD terminate its activities and that its duties of seeing that military needs for petroleum products are met be delegated, during the present standby period, to the Oil and Gas Division of the Interior Department and a reactivated Military Petroleum Advisory Board. These agencies should be staffed with competent men, to maintain the concept of service engendered in PAD. Should future emergencies confront the nation, petroleum industry leaders, given the opportunity, will again voluntarily cooperate with the government as wholeheartedly as they have through PAW and PAD.

—V.B.G.

You're just hours away

from a GENERAL CHEMICAL HYDROFLUORIC ACID SUPPLY POINT!

To supply industry's expanding needs for hydrofluoric acid, General Chemical has enlarged its "HF" plant at Delaware Works near Philadelphia—adding again to its extensive hydrofluoric acid facilities there and at Baton Rouge, La.

If you use "HF" in either aqueous or anhydrous forms . . . or in any grade from commercial to reagent . . . you will find General Chemical is geared to serve you well. From New York to California, General has eight strategically located "HF" supply points across the country, placing stocks of this essential acid only hours away from almost any consuming area.

For further information on how this "HF" supply line can be tied into your operations, just phone or write your nearest General Chemical office.

Basic Chemicals For American Industry

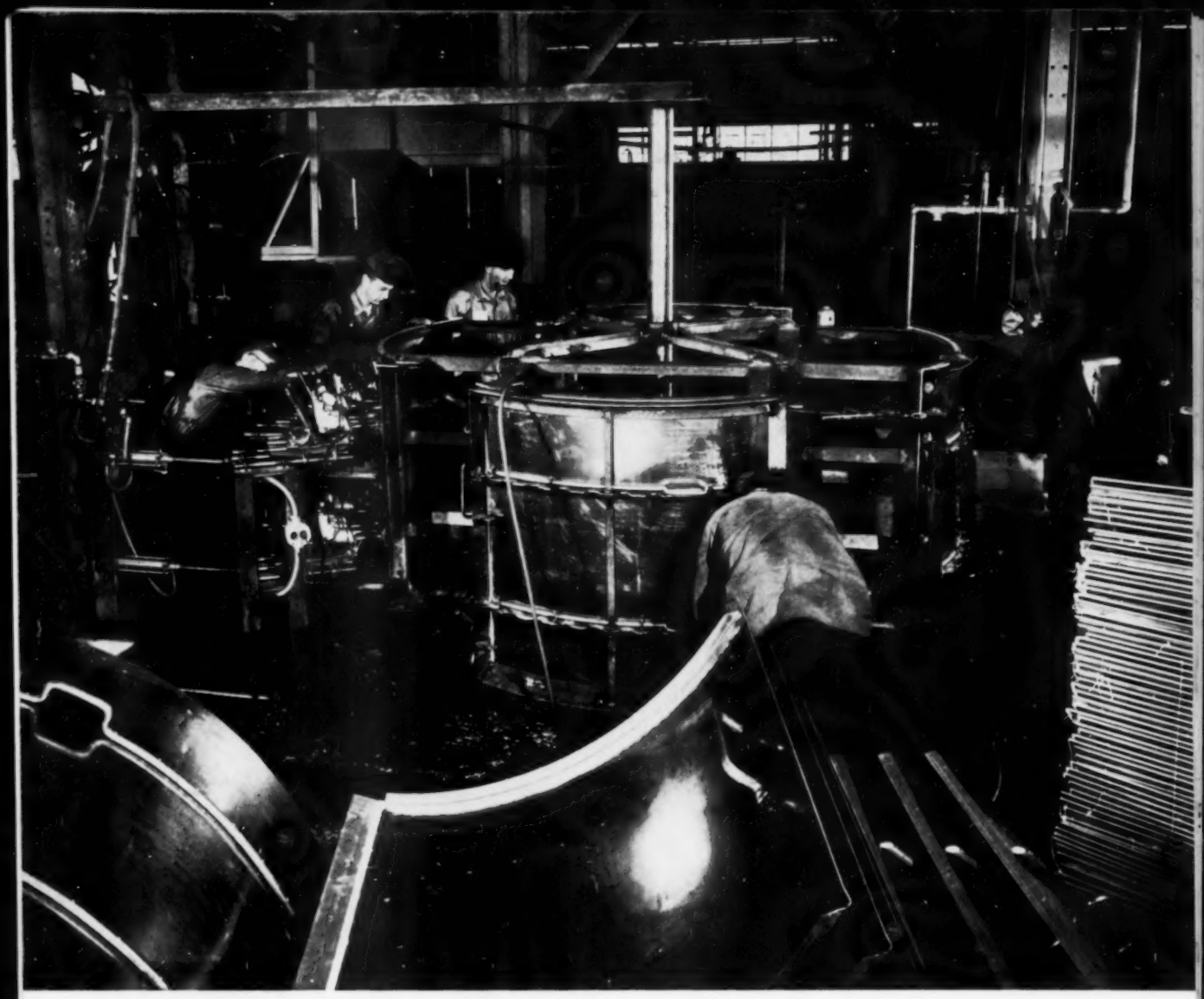
8 Distribution Points For General Chemical's Hydrofluoric Acid to give you faster, more efficient service:

Baton Rouge, La.
Buffalo, N. Y.
Chicago, Ill.
Cleveland, Ohio
Edgewater, N. J.
El Segundo (Los Angeles) Calif.
Marcus Hook (Philadelphia) Pa.
Pittsburgh, Pa.

GC Allied Chemical

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
Offices in Industrial Centers from Coast to Coast

FIRST IN FLUORIDES



Uniformity and Interchangeability . . .

● It was a MUST that Uniformity and Interchangeability be maintained in fabricating the covers for the electrolytic reduction cells in the Rockdale Works of the Aluminum Company of America, a requirement which Wyatt's accomplished while delivering this 70,000 pounds of finished aluminum parts without a rejection .

Wyatt's

HOUSTON-DALLAS-NEW YORK-TULSA

MANUFACTURERS AND ERECTORS SINCE 1913